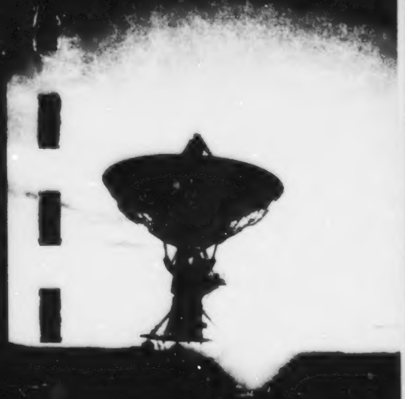

CLIMATE CHANGE COMMUNICATION

June 22-24, 2000
Kitchener-Waterloo, Ontario CANADA

Proceedings of an International Conference

Edited by:
Daniel Scott
Brenda Jones
Jean Andrey
Robert Gibson
Paul Kay
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Climate Change Action Fund
Fonds d'action pour le changement climatique

Environment Canada Environnement Canada

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The organizing committee sincerely thanks all those who participated in this conference, especially the presenters (oral and poster) who shared their knowledge and experience with us. Working together, we will be able to improve the capacity of the climate change communication community to meet this global challenge.

The organizing committee would also like to acknowledge the following individuals/groups for their participation, for without their assistance, this conference would not have been possible:

- Adaptation and Impacts Research Group (Environment Canada, Downsview) – in-kind support
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- Ryan Kennedy, Jessica Kwik and company (WPIRG) – student event theatrical performance
- Sondaky – public event native theatrical performance

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Introduction:
A Message from the Organizing Committee

Global climate change is an important challenge that we must embrace and, like you, we feel that communication is an essential element in the response to this challenge. Effective communication is important because it is a tool that can be used to identify problems, encourage participation, invite innovation in problem solving, and promote adaptation and mitigation. However, in spite of its capacity to fulfill these roles and the importance of climate change, the topic of climate change communication has received relatively little research attention.

Climate change is a complex issue that presents its own challenges for effective communication. First, the issue still lacks immediacy. Uncertainties on the response of the climate system, the environmental and socio-economic impacts, greenhouse gas emission reduction targets, and the reliability of climate model output further cloud the discussion rather than the certainties of this environmental issue. The nature and language of scientific climate impact assessments also make it difficult for the general public, policy makers and even decision makers to respond. Yet, communication is recognized as an essential part of the science-policy process.

Communicating the climate change issue requires the imparting of information to fulfill three expectations: 1) to raise awareness; 2) to confer understanding; and 3) to motivate action. This conference, through the presentation of applied and research case studies, has provided a foundation to begin addressing these issues by providing an opportunity to:

- **PROBE** the role of communication on perceptions of climate change,
- **EXAMINE** the effectiveness of different tools in raising awareness and contributing to understanding of climate change,
- **EXPLORE** the barriers that hinder effective climate change communication and subsequent motivation to action, and
- **PROFILE** climate change outreach initiatives.

In addition, global climate change cannot be addressed in isolation. Like you, we believe that this challenge and the communication measures needed to raise awareness and solicit responsible actions are best met through co-operation. As a participant in this conference, you have joined over 250 other delegates from four continents, representing over 100 different organizations actively involved in communicating climate change issues. They include governments, universities, non-governmental organizations, independent consultants, native communities and the media.

Although further work is needed, we should feel proud and encouraged by the variety and calibre of climate change communications work that was presented at this conference - both the theoretical and applied. Insight was provided into the theoretical underpinnings of effective communication and how best to apply these concepts to climate change messages, outreach activities, and behavioural change. Applied presentations provided the opportunity to share experiences and learn from the strategies of those who have been involved in communicating climate change through residential, government, academic, pop-culture, corporate, and educational outreach programs. In addition, various posters, book readings, public events, and theatrical performances showcased additional communication strategies.

We would like to take this opportunity to thank you for participating in *Climate Change Communication - An International Conference*. The purpose of this conference was not to debate the existence of climate change or the role of humans in the issue. Rather, it was to bring together those people actively involved in raising awareness of climate change to learn from each other, so that together we can improve the capacity of the climate change communication community to meet this global challenge. ❑

Sincerely,

The Organizing Committee

Jean Andrey
University of Waterloo

Indra Fung Fook
Environment Canada

Robert Gibson
University of Waterloo

Brenda Jones
Environment Canada

Paul Kay
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Linda Mortsch
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Table of Contents

Sponsors i

Acknowledgements ii

Message from the Organizing Committee iii

WELCOME PLENARY

Communicating about Climate Change: Challenges and Opportunities WP-1

SESSIONS

A1 CLIMATE CHANGE PERCEPTIONS 1: SCIENTISTS AND DECISION MAKERS

Speaking Truth to Power Revisited: Science, Policy and Climate Change A1-1

A Survey of Climate Change Beliefs: A Case Study of the Canada Country Study Participants A1-16

Climate Change Seen Through the Eyes of the Canadian Insurance Industry A1-29

Engaging Industry in Adaptation to Climate Change: A Perspective from the Geological Survey of Canada A1-36

A2 INFLUENCES ON PUBLIC UNDERSTANDING OF CLIMATE CHANGE

The Role of the Mass Media in Shaping Perceptions and Awareness of Environmental Issues A2-1

Why Climate Change is Not in the Air: Popular Culture and the Whirlwind Effect A2-8

Same Planet, Different Worlds: The Climate Change Information Gap A2-15

Brownlash Communication about Climate Change: An Analysis of Recent Publications by the Fraser Institute A2-23

A3 CIVIC ENGAGEMENT 1: ORGANIZATIONAL ROLES

The Role of NGOs in Promoting Climate Change: An EU Perspective A3-1

A Municipal Role in Climate Change A3-12

Public Education and Outreach to Reach Canadians: The Federal Perspective A3-13

A Scientist's Role in Communicating Climate Change A3-14

A4 NATIONAL & REGIONAL COMMUNICATION STRATEGIES 1: INITIATIVES FROM THE US NATIONAL ASSESSMENT

Engaging Stakeholder Participation in Assessing Regional Impacts from Climate Change: The Mid-Atlantic Regional

Assessment ... A4-1

Developing Scientific Methods, Tools, and Prototype Products for a North American Assessment of Vulnerability to Climate Variability and Change ... A4-10

Overcoming Barriers in the Use of Climate Information ... A4-20

B1 CLIMATE CHANGE PERCEPTIONS 2: THE PUBLIC

Ten Illusions That Must Be Dispelled Before People Will Act On Your Global Warming Message ... B1-1

Perceptions and Understanding of Climate Change in Sri Lanka (A Case Study) ... B1-6

Public Perception of Climate Change, the Precautionary Principle and Public Policy ... B1-9

B2 ASSESSING MEDIA REPRESENTATIONS OF CLIMATE CHANGE

Cycles upon Cycles: The Evolution of Media Attention to Global Climate Change ... B2-1

Is Mass Media Coverage of Global Warming Culturally Bound? A Comparison of French and American Coverage of Global Climate Change ... B2-9

The Case Study of Climate Change: The Nature of Risk and the Risk of Nature ... B2-21

Media Narratives of Global Warming ... B2-34

B3 NATIONAL & REGIONAL COMMUNICATION STRATEGIES 2: INITIATIVES FROM THE US NATIONAL ASSESSMENT

The Upper Midwest Aerospace Consortium Environmental Information Network: Building 'Learning Communities' in the Northern Great Plains ... B3-1

Low Snow, No Go in PNW ... B3-6

Native Peoples / Native Homelands Outreach ... B3-7

B4 PROMOTING COMMUNITY ACTION: A MUNICIPAL PERSPECTIVE

From Awareness to Action: Focussing the Climate Change Message ... B4-1

A Case Study of Municipal Climate Change Outreach Strategies for the Residential Sector in the City of Ottawa ... B4-8

Integrating Climate Change Analysis Into Community Planning Using Geographic Information Systems ... B4-17

Linking Air Issues: Co-Benefits as a Communication Strategy ... B4-24

C1 STAKEHOLDER FRAMING OF CLIMATE CHANGE

Negotiating Congruencies Among Multiple Interpretive Frameworks: Elite Representations of Global Climate Change ... C1-1

Impact of Framing on Willingness to Sacrifice to Reduce Greenhouse Gas Emissions ... C1-9

C2 COMMUNICATION AND THE SCIENCE-POLICY INTERFACE

The Science-Policy Process: Communication Distortions at Each Iteration ... C2-1

Communicating with the Media: A Scientist's Perspective ... C2-8

The Communication and Utilization of Research-Based Information: Moving Within and Beyond (Climate) Impact Assessments C2-9

On the Role of Research Programmes in Climate Change Communication. Experiences from the Dutch National Research Programme on Global Air Pollution and Climate Change C2-10

C3 CIVIC ENGAGEMENT 2: LESSONS FROM OTHER PARTICIPATORY PROCESSES

Congruence of Barriers to Public Involvement in Local Climate Change Initiatives and Environmental Assessment Processes C3-1

Learning to Engage: Experiences with Civic Engagement in Citizens C3-12

Assessing Adaptive Capacity in the Coastal Zone: A Case Study of the St. Croix Estuary Project C3-13

C4 CIVIC ENGAGEMENT 3: SOCIAL MARKETING STRATEGIES

Walking the Talk in Ottawa Through Community-Based Social Marketing C4-1

The Change Starts Here - A Climate Change Employee Awareness Pilot Project C4-8

Lessons Learned from the Blue Box Recycling Program C4-11

Taking Residential Energy Efficiency to the Streets: What Gets the Public Involved? C4-16

C5 PANEL DISCUSSION: COMMUNITY-BASED COMMUNICATION STRATEGIES ON AIR ISSUES

Panel Discussion: Community-Based Communication Strategies on Air Issues C5-1

PLENARY SESSION 2

Communicating the Science of Climate Change: A Mutual Challenge for Scientists and Educators P2-1

Importance of, and Obstacles to Communicating Science to Policy- and Decision-Makers: Climate Science in Retrospect P2-2

D1 GREENSPIRATIONAL ODYSSEY

Greenspirational Stories of Effective Environmental Activism D1-1

D2 CLIMATE CHANGE EDUCATION THROUGH SCIENCE FICTION

Narratives as an Educational Tool: A Review of *A Scientific Romance* D2-1

Depictions of Global Environmental Change in Science Fiction: An Overview of Educational Applications D2-10

"A Scientific Romance" – Reading and Reflection D2-19

D3

[session deleted]

D4 NATIONAL AND REGIONAL COMMUNICATION STRATEGIES 3

Sustainability in Sovereignty D4-1

Facilitating Stakeholder-Led Assessment of Climate Change Impacts: the UK Climate Impacts

Programme (UKCIP) ... D4-10
Climate Change Risk Communication: A Stakeholder-Based Approach ... D4-17
Communication and Engagement: A Review of Strategies from the Great Lakes-St. Lawrence Basin Project ... D4-26

D5 CLIMATE CHANGE CURRICULUM DEVELOPMENT STRATEGIES

Climate Change in School: Where Does it Fit and How Ready are We? ... D5-1
Climate Change Education – Understanding the Challenges ... D5-9
Educational Outreach Approach of the Climate Change Research Center ... D5-16

E1 VALUES AND RESPONSIBILITY

Signal to Noise: Listening For Democracy and Environment in Climate Change Discourse ... E1-1
From Global Framing to Local Action: Translation of Climate Change Impacts in Africa ... E1-11
Who are Our Neighbours? Personal Automobile Choice, Climate Change and Ethics ... E1-23
Theological and Ethical Dimensions of Addressing Climate Change: Reflections from the World Council of Churches (WCC) ... E1-30

E2 CIVIC ENGAGEMENT IN CLIMATE CHANGE 4: SCENARIOS AS COMMUNICATION TOOLS

Citizens' Perspectives of Climate Change in Europe: Perceived Barriers to Action ... E2-1
Communicating Uncertainties: Approaches and Experiences from Switzerland ... E2-9
A Coevolutionary Approach to Climate Change Impact Assessment in the UK ... E2-17
Using Integrated Assessment Models in Conversations with the Public: ULYSSES in Vancouver (Canada) ... E2-24

E3 LINKING CLIMATE CHANGE KNOWLEDGE AND ACTION

Global Environmental Change: Modifying Human Contributions Through Education ... E3-1
Climate Change Knowledge and Attitudes: Links to Action in the Residential Sector ... E3-11
Developing a Measure of Public Understanding of Climate Change and Willingness to Act When Science is Uncertain ... E3-21
Embracing Uncertainty in Climate Change Decision-Making ... E3-28

E4 STAKEHOLDER ENGAGEMENT 1: YOUTH AND EDUCATORS

Engaging the Public: Starting with our Children ... E4-1
Greenhouse Gas Reduction in Canadian Schools ... E4-11
Youth in Media – Engaging Youth in Change ... E4-14

F1 INFLUENCE ON PUBLIC UNDERSTANDING OF CLIMATE CHANGE 2

Public Confusion over Climate Change: The Role of the Media ... F1-1
The Mismatch Between the Cultures of Journalism and Science ... F1-5

F2 CIVIC ENGAGEMENT 5: MOTIVATING CHANGE

Marketing Climate Change with Protective Shelter F2-1

Count Me In! Results of a Research Project to Measure the Impacts of Thirty Workplace-based Workshops to Raise Awareness of Climate Change and Stimulate Personal Action F2-4

The Sustainable Living Bus - Motivating Change F4-9

Using the Climate Change Calculator to Link Lifestyle Choices and Environmental Consequences F4-13

F3 STAKEHOLDER ENGAGEMENT 2: AGRICULTURAL SECTOR

Planning for Climate Change in Agriculture F3-1

Achieving Understanding in Agriculture GHG Emission Reduction F3-9

How is Climate Change Relevant to Farmers? F3-18

F4 PANEL DISCUSSION: DEVELOPMENT OF AN INTERNATIONAL CLIMATE CHANGE COMMUNICATION NETWORK

Using a Knowledge Network Model for Research and Communications on Climate Change: The Experience of the International Institute for Sustainable Development F4-1

G1 COMMUNICATION OF NATURAL VARIABILITY AND EXTREMES

Commune Linga Concordiam Parit: Building the Common Language of Risk G1-1

The Value of Understanding Natural Climate Variability and Its Impacts as a Bridge to Thinking About Climate Change G1-2

Bringing Climate into the Daily Weather Broadcast G1-10

G2 EFFECTIVE EXCHANGE OF CLIMATE CHANGE INFORMATION: THE ROLE OF LIBRARIES AND THE INTERNET

Global Climate Change Information: The Role of Libraries in Removing Barriers to Information G2-1

Regional Community Web Site G2-16

Climatechangesolutions.com: A Study of How the Internet Creates Action G2-17

G3 CLIMATE CHANGE THROUGH INUIT EYES

Inuit Observations of Climate Change G3-1

WORKSHOPS

1. Climate Change in the Classroom – Beyond the Printed Page W-1
2. Bridging the Gap from Tech Talk to Street Speak: Communicating Science to Non-Scientists W-11
3. Creating a Climate for Change W-12
4. Youth and the Internet W-16
5. Climatechangesolutions.com: A Study of How the Internet Creates Action W-17

6. Count Me In! A Workplace-Based Program to Raise Awareness and Stimulate Personal Action on Climate Change **W-18**

PUBLIC FORUMS

Public Outreach Events to Raise Awareness of Climate Change in the Local Community **PF-1**

POSTER PAPERS

Abstracts of Climate Change Posters that Were Presented at the Conference **PP-1**

ALTERNATIVES JOURNAL

Climate Control: Special issue investigates opportunities for cutting greenhouse gas emissions **AJ-1**

DELEGATE LIST

List of participants at time of printing DL-1

Welcome Plenary

Communicating About Climate Change: Challenges and Opportunities

Jean Andrey[1] *and Linda Mortsch*[2]
1. University of Waterloo
2. Environment Canada

Communicating About Climate Change: Challenges and Opportunities

Jean Andrey and Linda Mortsch

Over the past decade, global climate change has emerged as one of the most intensely researched and discussed environmental issues ever. Despite this, carbon emissions continue to increase both globally and domestically, and society continues to be vulnerability to climate variability and change. This raises questions about the effectiveness of current communication efforts. As an introduction to the conference, this paper summarizes the salient characteristics of global climate change, defines communication challenges associated with these characteristics, and outlines some guidelines and opportunities for partially addressing these challenges. The main sources of published information are journal and conference papers in the fields of climate change, environmental education and risk assessment. Examples of communication efforts are drawn from Canadian governments, ENGOs, industries and the media.

INTRODUCTION

It has been twelve years since 'the summer of 1988' and the establishment of the Intergovernmental Panel on Climate Change. Since that time, global climate change has emerged as the most intensely researched and discussed environmental issue ever, with many millions of dollars being spent on efforts to understand causes, anticipate future climatic conditions and their associated impacts, and consider appropriate responses. Despite the abundance of expert knowledge on these topics, and the many communication efforts, greenhouse gas emissions continue to increase in most jurisdictions and societal vulnerability to climate variability and change remains high. This raises questions about the effectiveness of past and present efforts to communicate relevant information to the various publics and policymakers. It also raises questions about the role of information in moving forward on the climate change agenda.

Communication involves imparting knowledge with the intent of raising awareness and promoting understanding. In many contexts, such as environmental education and emergency planning, communication is thought to be effective only when these changes in awareness and understanding result in attitudinal adjustments and/or improve the basis upon which decisions are made.

An inventory of the amount and type of climate change information that has been disseminated does not exist, but it is clear that a good deal of information has reached the public-literally dozens of related news stories appear each month in major papers around the world. There is also considerable evidence that awareness of climate change is at an all-time high. For example, polls indicate that at least three-quarters of Canadians have heard of climate change (Pollara 1998). But more importantly, climate change has become part of the lexicon of the North American public, as evident by the appearance of climate change cartoons and greeting cards. Perhaps the ultimate proof of this is what occurred on March 21st 2000. In the popular game show, "Who Wants To Be a Millionaire?", the following question was asked: "What gas is primarily responsible for the greenhouse effect? (a) hydrogen, (b) oxygen, (c) nitrogen or (d) carbon dioxide. What is significant is not that the question was asked, but the dollar value associated with it. The greenhouse effect was a $1000 question, a clear sign that virtually any contestant would be expected to know the answer.

But just because information is "going out", doesn't mean that it's "going in". Has understanding been improved? Have people's attitudes changed? Do decision makers have a better basis on which to act? In the early 1990s, Skea (1992) concluded that public attitudes were a mix of ignorance, apprehension and confusion; and Changnon et al. (1992) noted that scientists thought that global change communications were confusing and misleading to the public. Have things changed since then? Which communications have been 'successful' and why? How might we improve our efforts? These are some of the key questions to be considered at this conference.

The goal of this paper is to provide an overview of some of the challenges and opportunities associated with communicating about human-caused global climate change due to an "enhanced greenhouse effect". For this, we draw on published information, primarily from the fields of climate change, environmental education and risk assessment. The paper is organized around three aspects of the climate change communication issue. First, the dominant characteristics of global climate change are identified. Second, communication challenges associated with these characteristics are defined. Finally, a set of guidelines is developed to partially address these and other more generic communication challenges.

THE CLIMATE CHANGE ISSUE: CHARACTERISTICS, BARRIERS, AND GUILDELINES FOR COMMUNICATION

Issue # 1: Complexity

Characteristic: Global climate change is a complex issue.

From a natural science perspective, the global climate system in enormously complex, primarily because of the large number of linkages/feedback mechanisms. A change in one variable/locale causes a response in the system, which may be manifest in unexpected ways or in faraway places. Global circulation models (GCMs) are our best approximations of the workings of this system and, although these models have been steadily improved over the past two decades and presently require super computers to run, still they do not nor cannot ever do justice to the complexities of the real world. The socio-political-economic system is also highly complex and dynamic. Thus, selecting and translating knowledge into comprehensible public messages is no easy task.

Associated Challenge: Citizens are not well informed.

As noted above, increasingly more and more people have heard of "global warming". Despite this, however, the level of understanding is quite low. The findings of several recent polls suggest that many Canadians have no clear understanding of the meaning, causes or effects of climate change; in fact, the key links between climate change and human activities, such as energy use and deforestation, cannot be identified by a substantial portion of the population (Patry 2000). People do not differentiate neatly between this problem and other global environmental problems. Of even greater significance is the fact that the low level of understanding is not restricted to Canada. Rather, Bord et al. (1998, 75) note that "Errors in assessing causes of global warming are global in nature".

In particular, climate change is often confused with ozone depletion, and a large number of both citizens and experts erroneously think that depletion of the ozone layer is a principal cause of global warming (Henderson-Sellers 1990; Lofstedt 1991; Kempton 1991a, 1991b; Bostrom et al. 1994; Read et al. 1994; Bord et al. 1997; Mortsch et al. 2000). For example, in a recent Canadian poll, respondents were asked, "What is climate change?", and 12 percent replied that it is a problem with the ozone layer (Pollara 1998). While ozone-depleting substances (e.g. CFCs) are also greenhouse gases, ozone depletion itself has only a minor effect on the global energy budget, and is now thought to have a net cooling effect. This confusion, which is propagated by some news reporters (as shown below), has implications for action.

> "Methane is one of the most dangerous of all greenhouse gases. It is 32 times as dangerous to the ozone layer as carbon dioxide, which is created when the methane is burned off" (The Toronto Star, Oct. 19, 1999)
>
> "Scientists around the world believe carbon dioxide emissions, known as greenhouse gases, are depleting the ozone layer, resulting in global warming and a host of other environmental troubles ..." (Red Deer Advocate Sept. 17, 1999, B4).

Overcoming the Barriers: We must made prudent choices about communication goals, and build the knowledge base one step at a time.

Information must be presented in a way that reflects the complexity of the subject, but does not further confuse and overwhelm. This means that choices must be made on what details to communicate. As our cumulative knowledge explodes, it becomes impossible for any individual to have detailed knowledge on every aspect of the issue. We must focus on what is relevant to making informed decisions, and build the knowledge base one step at a time.

Cognitive theory indicates how knowledge accumulation occurs. It states that individuals create mental models or maps, which consist of networks of objects that serve as a representation of the world (Bardwell 1991; Kearney 1994; Rowan 1994). Therefore, rather than randomly sampling information from the environment, people rely on these cognitive maps that they build through life experience. Communicators can help with this task of building mental maps by providing a sense of the big picture and adding new information that builds on these mental maps.

However, we are all prisoners of our experience to some extent. When conclusions seem counter-intuitive or run counter to existing beliefs/understandings, they can be very hard to accept. Rowan (1994) notes that, in these cases, educators suggest the following four steps: (1) state the erroneous but plausible notion; (2) acknowledge its apparent plausibility; (3) demonstrate its inadequacy by noting inconsistencies between it and evidence familiar to the audience but not yet considered; and (4) present the more accepted view and demonstrate its greater adequacy. This approach would seem to hold the greatest promise for dispelling myths about the economic implications of low carbon futures (e.g. Torrie and Parfett 2000).

Issue # 2: Uncertainty

Characteristic: There are uncertainties about virtually every aspect of the climate change issue, and these increase as one moves from natural to human systems.

Uncertainty, which is a basic component of all research, planning and decision-making, permeates the global climate change literature. The various uncertainties arise from different sources and are not easily overcome. As noted by Covello (1989), there are four main sources of uncertainty in risk. These are: (1) statistical randomness or the variability of nature; (2) lack of scientific knowledge on the processes at work; (3) lack of scientific data; and (4) imprecision in risk assessment methods because of variations in protocols for the conduct of research. All four are relevant to the climate change issue. Uncertainty has helped to foster a wait-and-see attitude, and has played a central role in skeptics' responses to information on climate change, especially policy proposals.

Associated Challenges:

1. *The language of global climate change is problematic.*
2. *The public has been exposed to scientific debates, often in an overstated way, primarily through the media.*
3. *Personal experiences are not always consistent with climatic trends or scientific projections.*

The various uncertainties are reflected in the language that scientists use when discussing climate change. Future climates are presented as scenarios, estimates or return periods; and potential impacts as probabilities, risks or ranges. This type of language, while precise and meaningful to the research community, presents a major communication obstacle to other audiences. Studies in the field of risk communication indicate that most people do not comprehend probabilistic concepts.

Another challenge is that skeptics have seized on the uncertainty issue. As noted by Dotto (1999, 2000), Gelbspan (2000) and Smith (2000), those with different views or interests in the fossil fuel or transportation sectors have launched a successful campaign aimed at delaying political action on greenhouse gas emission reductions, by using scientific uncertainty as the cornerstone of their argument (see for example Stewart 1995 in The Coal Association of Canada's newsletter). And the media has sometimes exacerbated the problem-by selective coverage, building upon the conflict, misinterpretations of scientists work and giving nearly equal coverage to both sides of the argument, even though the balance of evidence supports assertions that (1) humankind is having a discernable influence on the climate system, (2) consequences are potentially serious, and (3) many of the proposed greenhouse gas reduction responses may have both environmental and economic benefits.

Finally, climate change lacks credibility because people's belief systems are very much intertwined with personal experiences. Inconsistencies in the climate signal raise doubt in people's minds. For example, the late 1980s were an exceptional time-drought in the grain-growing regions of North America, Europe and Asia; hurricanes in the Caribbean; heat waves in China; and one of the mildest winters in centuries in the United Kingdom-and this was associated with increased belief in climate change. But when the drought and temperatures of the late 1980s were not maintained, some of the audience lost interest in the climate change issue.

Overcoming the Barriers:
1. *Choose language that is appropriate to the audience.*
2. *Be honest about uncertainties, but focus primarily on the weight of evidence.*
3. *Capitalize on situational opportunities*

Because the public is neither science- nor risk-literate, technical presentations are often unsuccessful. Denominators like 'per million person years' do not have meaning, largely because they are not imaginable. Many studies in the field of risk assessment demonstrate that narrative presentations (e.g., dramatized or personal accounts) are associated with better responses than technical presentations (Golding et al. 1992). And there are various examples of such approaches from which we might learn (see for example the CCAF project database). Wording is also important; research in instructional design shows that when people struggle to understand the meaning of a term or concept, they are in fact struggling to distinguish the term's critical (always present) features from its variable (only sometimes present) features. To overcome language problems, Rowan (1994) suggests the following: (1) substitute a more easily understood term if doing so will not mislead; (2) if the difficult term is really the best choice, then use it and define it by its critical attributes; or (3) give examples and non-examples of the term's use. These rules of thumb should be remembered by scientists in their public communications on climate change.

As noted by Dotto (2000, 10), "Uncertainty exists. It will not go away." At the same time, however, there is a large degree of consensus on many of the important processes and issues. In particular, the "greenhouse effect" is one of the most established principles in meteorology. Also, the vast majority of scientists and the balance of scientific evidence suggest: (1) a continuing increase of greenhouse gases in the atmosphere, (2) a discernable human influence on global climate, and (3) a general increase in surface temperature. Furthermore, current GCMs, despite their imperfections, do adequately describe the general features of the current climate, and have successfully simulated historical climatic trends and the cooling effects of volcanoes. These points should be emphasized in public communications.

Third, the episodic nature of public interest in climate change is well documented. Public interest in global warming tends to be greatest in the wake of major weather anomalies (Ungar 1992). Such episodes need to be capitalized on, since information is most likely to lead to behavioural changes when public awareness is high. The greater challenge, however, is to maintain response when visibility of the issue recedes. Some conservationists argue that the key is to ensure that actions taken during crises will have some carry-forward momentum. Possibilities include ensuring that some investment/experience in new technology/lifestyle has occurred which will prevent back sliding, e.g. investing in a thermostat that automatically turns down the heat at night can combat apathy once an energy crisis is over. Also permanently changing the behaviour of a minority can have major ripple effects as role models or success stories impact others through example and/or peer pressure.

Issue # 3: Nature of Anticipated Effects
Characteristic: The impacts of climate change will be borne disproportionately by people in less developed countries and by future generations.

The implications of human-induced climate change will accrue to future generations. The most devastating impacts are expected to occur in places with limited fresh water, in areas prone to drought, on coasts and generally in less developed countries. Disadvantaged people, countries and regions will bear the brunt of impacts because of high vulnerability and low resilience. Expected impacts include reduced crop production (especially in low-latitude countries), water supply shortages (affecting up to 2 billion people), and dislocation due to sea level rise (e.g., small islands and deltaic coasts) (IPCC 1996).

Challenge: For many of us, global climate change lacks immediacy/urgency.

Some experts believe that recent weather anomalies are signs that our climate system has been destabilized by greenhouse gases, but many scientific papers suggest that climate change may not be clearly detectable for some time. The public is more interested and more prepared to act when presented with facts and immediate threats rather than probabilities and future risks. The perception that climate change is a slow, gradual change in temperature oversimplifies the issue, and fosters apathy. Spatial/regional variations in vulnerability and anticipated impacts and opportunities are also an issue. For people living in North America, especially in the Great Lakes Basin, climate change lacks immediacy in both time and place. Furthermore, many of the characteristics that are associated with high-risk salience are missing with climate change-there is no dread component to motivate because the impacts of climate change are diffuse rather than concentrated, indirect rather than direct, unintended versus intended, and will accrue to statistical/anonymous individuals rather than to identifiable people. Also, climate change will be associated with both threats and opportunities. In such circumstances it is common for the public to be optimistic about their own welfare, and it is particularly difficult for people living in the mid-latitudes to connote warmer temperatures with a threat. The result is public apathy. The limited perception work that has been done bears this out. Although environmentalism has been a powerful social and political force for more than two decades (Dunlap 1991; Sachsman 2000), polls indicate that climate change continues to have low salience (e.g., Immerwahr 1999).

Overcoming the Barriers
1. Advocate the precautionary principle.
2. Do not avoid ethics/justice issues

Uncertainty or lack of scientific proof is often a barrier to action. In decision making there is frequently a 'continuum of credibility' between considering something as dangerous to the environment or human health and scientific proof that it is indeed harmful and requires action (IJC, 1995). At what point is there sufficient proof for action? The precautionary principle/approach espouses prudent action in advance of formal scientific proof of cause-and-effect relationships where there is threat of serious or irreversible damage now or for future generations and where action can be justified on reasonable judgments of cost effectiveness. It is not reasonable to claim scientific uncertainty as a reason for delay. Key elements of the precautionary principle are a willingness to take action; concern for future generations; judging the cost-effectiveness of action; recognizing the intrinsic value of non-human entities; and shifting the onus of proof (O'Riordan and Cameron, 1994).

Communications on global climate change must instill a sense of responsibility for the globe and future generations. Research has shown that people are more willing to pay for risk reductions if there is a direct personal threat, but even when this is missing there are issues of responsibility and ethics because: (1) there is the potential for catastrophes (fatalities and injuries grouped in time and space); (2) climate change results in involuntary exposure to risks; (3) it is caused by human actions and failures; and (4) perhaps mostly importantly, any negative impacts will be borne disproportionately by future generations and by the most vulnerable/impoverished members of society. Global warming is therefore primarily an ethical issue (Jamieson 1992) and this must be communicated to the public.

Issue # 4: Action
Characteristic: The causes of human-induced climate change are embedded in our present and preferred lifestyles.

Lifestyle is "a complex bundle of values, objectives, institutions and activities, with ethical, environmental, economic and social dimensions" (Ekins 2000, 70). Since the start of the industrial revolution, lifestyles, especially in developed countries, have been intertwined with extensive use of energy derived from the burning of fossil fuels. World primary energy use currently exceeds 300 EJ, with much of it being used by individuals for residential heating/cooling and personal transportation by automobiles. Thus human-induced climate change is due to the cumulative impacts of billions of people going about their daily lives.

Challenges:

1. *The scale of the issue requires unprecedented cooperation.*
2. *For individuals, there is a sense of helplessness.*
3. *There are more important and/or competing issues.*

Global climate change forces us to acknowledge our global interdependence. The issue is truly global in nature, and it respects no political boundaries. Therefore, both mitigation and adaptive response strategies will require the unprecedented cooperation of the various nations, sectors and stakeholders groups. While the Kyoto Protocol signals that nations are beginning to work together on this issue, we are still a long way from policies that would stabilize atmospheric carbon concentrations of greenhouse gases.

The unwillingness of nations to 'go it alone' is repeated at the individual level. Climate change is a classic case of the commons dilemma-what is rational at the individual level may be catastrophic at the global scale. The obstacles and costs faced by individuals who are motivated to change are perceived to be, and indeed often are, very significant.

This fosters a sense of helplessness/hopelessness, especially when others do not change. What possible difference can one individual make?

Also, the public is bombarded with many problems-unemployment, crime, social inequities, public deficits and environmental degradation. When people are asked to identify the most important issues facing society, they typically put environmental hazards/problems well below many economic, social and political issues (Whyte 1985; The Environmental Monitor 1992; Pollara 1998). Even on the environmental agenda, issues such as toxic chemicals, air and water quality, ozone depletion, deforestation and acid rain tend to have a higher profile than climate change.

In addition, there is widespread concern that conventions/treaties to limit the emissions of greenhouse gases would interfere with economic growth. Thus mitigation policies emerge slowly and face much opposition. Opportunities for creative solutions that simultaneously address more than one issue are not always explored because of the compartmentalization of responsibilities, knowledge and power.

Overcoming the Barriers:

1. *Put pressure on upper-level governments to create a policy environment that engenders voluntary and sustained action.*
2. *Concentrate on what is doable for different groups.*
3. *Capitalize on opportunities to piggyback the global climate change issue on other environmental and social issues.*
4. *Do not expect communication alone to solve the problems and/or resolve conflict.*

Social surveys indicate that most people think that the climate change issue should be addressed by international organizations, such as the United Nations, and national governments. However, in democratic societies at least, it is important that citizens become active lobbyists to keep the climate change issue on the political agenda.

When it comes to individual actions, people are looking for guidance on which dangers are real and what can be done to reduce or prevent them. Therefore, in addition to improved understanding, actions (both mitigation and adaptation) need to be specified. Hungerford and Volk (1990) argue that there has been too much emphasis on information (increased understanding) and not enough emphasis on developing ownership and empowerment in learners (action). The public needs help in translating the 'think globally, act locally' slogan into action. From a behavioural perspective, there are three different types of actions—investments (e.g. home insulation), management (thermostat setback at night), and curtailment of amenities and comfort. The three require different approaches and present different obstacles. At present, the first two types are more likely to bring results quickly because of the difficulty of convincing the masses that sacrifice is desirable. In fact there is evidence that young people were more willing to sacrifice for environmental concerns two decades ago than they are today (Gigliotti 1991). At some point, however, environmental education must strive to define a new social "norm".

In terms of the link between climate change and other public issues, Trevitt (1989) argues that we should consider the environment in its totality when developing environmental education and training and that we should in essence look at the interconnectedness of issues like pollution, environmental change, national security and human health. The growing interest in redundant solutions (e.g. transportation systems that pollute less and, at the same time, are less vulnerable to weather extremes) and co-benefits in an encouraging sign.

Finally, it is worthwhile to consider the role of communication in climate change action plans. There is a general assumption that communication leads to improved understanding which in turn affects attitudes, which ultimately leads to changed behaviour. There are, however, many examples of attitude-behaviour discrepancy and it is generally accepted that constraints/obstacles are the main factor. People are free to choose only within the limits provided by the market, the government, and their social and economic circumstance. Sayre (1991) believes that behavioural changes need to be preceded and reinforced by changes in societal norms toward the environment. In a slightly different vein, Yarnale (1991/92) argues that institutions, not people, need to change ... that regulations are an important missing ingredient. At any rate, the constraints to action need to be identified and attempts must be made to remove them. We should not expect communication alone to resolve the problem. Nor can we expect communication to necessarily resolve conflicts, as conflicts often originate in competing interests.

GENERIC COMMUNICATION GUIDELINES

In addition to issue-specific challenges, there are a number of principles of communication that apply to virtually any issue or situation. A number of these are identified below, as they seem particularly relevant to the burgeoning 'field' of climate change communication.

Carefully define communication goals.

Although it is not clear at this point, it appears that some of the communications about climate change have been undertaken with no specific goal/target in mind. The education field has long established the need to define communication goals before the development and delivery of information. Each goal type has its own set of obstacles and these need to be identified and addressed through research-supported methods.

Identify and characterize the intended audiences.

Communication strategies should be audience-specific. When it comes to the climate change issue, it is clear that there are many publics, and communication activities should be matters of conscious design, taking into consideration the backgrounds of the potential recipients of the messages-their biases, perceptions, values, belief systems and knowledge base. The choice of communication outlet is also important. For example, McGeachy (1988) notes that many Americans depend on magazines for information but readers of general-orientation magazines receive very little environmental coverage.

Have those working on the front lines well informed and committed.

Climate change communication involves many different individuals and groups. There is a real need for spokespersons to have a solid understanding of the issues so that they can respond appropriately. Spokespersons also need training on listening, interaction and presentation skills, and their actions need to be consistent with their message if they are to have credibility.

Develop communication partnerships. Identify possible message intermediaries and work with them.
One obstacle to a better informed public is the dynamic nature of knowledge. Scientific understanding of climate change continues to advance, leaving communicators without current information. As a way of improving global change education in the school systems, there are now several examples of scientists and educators working together (e.g. Fortner and Mayer 1990; Cheek 1991; Henderson and Holman 1993). But many more such partnerships are needed. In particular, the scientific community and other experts must not forfeit opportunities to work with/speak to the press. The broad coverage and relative credibility of the media provide an enormous opportunity to reach the general populace on issues related to environmental stewardship and/or risk (Winsten 1985).

Ensure that communication is not just one-way.
Educators/communicators need to provide opportunities for and take seriously the feedback from the public, media, industry, and other decision makers. The risk literature talks of partnerships, sharing, effective dialogue and of a convergent versus linear communication model (Bradbury 1994). There is a general feeling that officials/authorities are insensitive to the information needs and concerns of the public when it comes to most risks. People must be given a reason to listen. They must be given enough power and say in the decision making that they feel they have a stake in listening thoughtfully. Spranger (1989) and others maintain that not much thought or coordinated effort has been given to citizen involvement and education on the global climate change issue.

Learn from other fields and from retrospective/evaluative studies of risk communication efforts.
There are many communication lessons to be taken from other areas; there is no need to re-invent the wheel. There are some examples of communication guidelines in the context of risk management (Covello et al. 1987; Covello 1989; Van Eijindhoven et al. 1994; Lundgren 1994). Other areas from which we can learn include the conservation literature, especially the energy conservation field because of the link between greenhouse gases and energy use. Some of the principles and standard tools of education should also be incorporated. These include, for example, the relatively greater effectiveness of active versus passive learning and the need for repetition and reinforcement; as well as the careful use of comparisons, indexes, examples, parables and a variety of visual aids. Finally, there is the need to evaluate climate change communication programs that have been implemented. There are some recent examples (Krosnick and Visser 1998), but Fisher et al. (1994) note that few organizations have the courage to evaluate their risk communication. This is necessary if progress is to be made.

CONCLUDING STATEMENT

Since the Second Assessment Report of the IPCC (1996), there has been a virtual avalanche to publications—academic articles, government reports, industry assessments/position papers, media coverage, action-oriented brochures, curriculum guides—and an enormous amount of dialogue. Public awareness of climate change is high. So the ultimate question is 'How can we capitalize on this awareness in order to bring about policies/programs/actions that are consistent with the principles of sustainable development?'

We humbly present the following communication guidelines as a starting point, and anticipate that conference delegates will share other ideas as the conference unfolds:

1. We must made prudent choices about communication goals, and build the knowledge base one step at a time.
2. Choose language that is appropriate to the audience.
3. Be honest about uncertainties, but focus primarily on the weight of evidence.
4. Capitalize on situational opportunities.
5. Advocate the precautionary principle.
6. Do not avoid ethics/justice issue.
7. Put pressure on upper-level governments to create a policy environment that engenders voluntary and sustained action.
8. Concentrate on what is doable for different groups.
9. Capitalize on opportunities to piggyback the global climate change issue on other environmental and social issues.

10. Do not expect communication alone to solve the problems and/or resolve conflict.
11. Carefully define communication goals.
12. Identify and characterize the intended audiences.
13. Have those working on the front lines well informed and committed.
14. Develop communication partnerships. Identify possible message intermediaries and work with them.
15. Ensure that communication is not just one-way.
16. Learn from other fields and from retrospective/evaluative studies of risk communication efforts. ❑

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Session A1

CLIMATE CHANGE PERCEPTIONS 1: SCIENTISTS AND DECISION MAKERS

Speaking Truth to Power Revisited: Science, Policy and Climate Change
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A Survey of Climate Change Beliefs: A Case Study of the Canada Country Study Participants
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3. Pennsylvania State University

Climate Change Seen Through the Eyes of the Canadian Insurance Industry
Douglas Macdonald
University of Toronto

Engaging Industry in Adaptation to Climate Change: A Perspective from the Geological Survey of Canada
Paul Egginton
Natural Resources Canada

Speaking Truth to Power Revisited: Science, Policy and Climate Change

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Dennis Bray

The issue of climate change from the perspectives of climate change scientists and climate policy makers is discussed using results from two survey questionnaires. Emphasis is given to the German context. Included is the self assessment of the state of the art of the climate sciences and the importance assigned to different sources of information by policy makers. Conclusions indicate that policy makers rely on a number of sources other than the direct results of science, and have assigned a greater sense of urgency to the issue of climate change than have scientists.

INTRODUCTION

The issue of global climate change presents itself as somewhat of an exemplar in the fact that it encompasses the characteristics of post-normal science, that is, science conducted in the context of potentially high stakes and with a high degree of uncertainty(see Funtowicz and Ravetz 1985; 1990a; 1990b; Bray and von Storch 1999). It is also an exemplar in that it is representative of what perhaps could be called encroaching post-normal problems, that is, the issue is a problem in the sense that it exercises the mind, but it is not normal if normal is perceived of as something which conforms to a standard or regularity, or that which is usual or typical. The issue of global climate change has now extended well beyond those conditions. 'Normal' would imply at least the existence of a precedent.

The resolution to such problems extends beyond a scientific understanding of the natural world to include the interpretation of identified risks, the ways the risks might be negotiated, and the consideration of unforeseen consequences. While the necessity of such considerations is not new, the *realization of this necessity* is distinguishing and the interface of the roles of science, politics, ethics, mass media, technologies, and cultural definitions cannot be ignored. Such an interface requires intricate communications. The following concerns the interface between only two of these categories, namely between science and politics. This is a double process in which first, scientific expert knowledge - information in other contexts - must be transformed into a more general context of practical, pragmatic knowledge and second, the knowledge must be communicated.

The Oxford English Dictionary (1993) define the verb 'to know' as "recognize, perceive, identify [...] to comprehend as fact or truth". In short, knowledge extends beyond the mere collection of data and information. The transformation of data or information into knowledge implies the application of subjective assessment. The difficulty is well noted: "Information scientists are currently confronted with the need to distinguish information gathering from knowledge building. For example, criticism of the World Wide Web stems from a lack of knowledge structure in the unorganized information system. User frustration with the system is due to an inability to determine truth from falsehood, to build the proper context around information to make it usable, to make sense of it." (Glynn and Laskaris: http://hsb.baylor.edu/ramsower/ais.ac.96/papers/glynn.htm). As a metaphor, this can be applied to the issue (and related uncertainties) of global climate change. In an effort to make sense of the information we have collected we have constructed information (*expert* knowledge) silos. In the case of climate change, the information silo, at the international level, is represented by the IPCC. Consequently it is also imperative that this paper not only addresses the communications between science and politics, but also the major issue of the funneling and channeling of information. It is at these silos that attempts at the transformation of information into knowledge occur. Consequently, their, in this case the singular IPCC, utility requires assessment. In fact the utility of such information silos might be assessed by their ability to act as a stimulus for the process of knowledge building, in which reason and the perceptions of rationality become forces of the transition of information to knowledge.

The following does not attempt to provide a solution to these problems but rather to specifically identify the problem areas drawing from the concepts noted above and using data collected from an international survey of climate scientists (Bray and von Storch, 1996) and a survey of German policy maker (Krück and Bray,1998) given the task of dealing with the climate change issue. The analysis of the climate sciences is comparative among nationally designated science communities, while the communications between science and policy is limited to an example drawn from the German science community and the German policy making sector.

THE SURVEY OF SCIENTISTS

The survey of climate scientists (Bray and von Storch: 1996) began with a series of in-depth interviews conducted with climate scientists located in major institutions in the USA, Germany and Canada. A list of pertinent themes was abstracted from the interviews and used to construct a survey questionnaire. In 1996, the questionnaire was distributed to 1000 scientists in North America and Germany. An early publication drew requests to include other national science communities and subsequently Denmark and Italy were added to the data set in 1997.

The sample for the North American segment was drawn from the *EarthQuest* mailing list. Due to the fact that the mailing list contained people other than climate scientists, a true random sample could not be drawn. A final sample size for North America of 460 US scientists and 40 Canadian scientists was selected. The sampling of the German science community, due to reasons of confidentiality, was beyond full control. A random sample of German scientists was drawn from the mailing list of the *Deutsche Meteorologische Gesellscahft* by its administration, resulting in the distribution of 450 surveys. A further 50 questionnaires were distributed to the members of the Max-Planck-Institut für Meteorologie, Hamburg and members of the University of Hamburg. The Danish sample was drawn from the membership of the Danish Meteorological Society, by the Danish Meteorological Society, and consisted of a random sample of 100, and the Italian sample of 240 was drawn from lists of members of related academic departments. Final response rates are given in Table 1.

The selection of countries is representative of a variety of vested national interest, both economic and environmental. For example, the geographical vastness of North America means a number of climatic zones and long coastlines to deal with, both for science and for politics. Germany, on the other hand, is somewhat more geographically and climatically homogeneous. Both Denmark and Italy face increased risk of rising sea levels. In short, the selection of countries is representative of a diversity of interests.

THE VOICE OF TRUTH

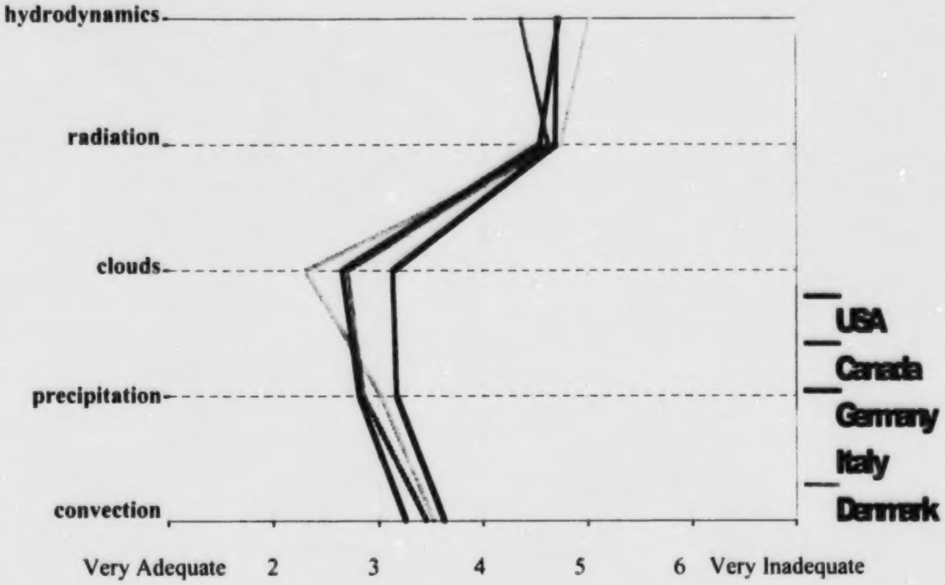
In this section, some areas of contention and consensus within the scientific communities are explored. This is the voice presented to the decision makers. To begin, consensus regarding the integral parts of climate science

TABLE 1. Response rates to survey

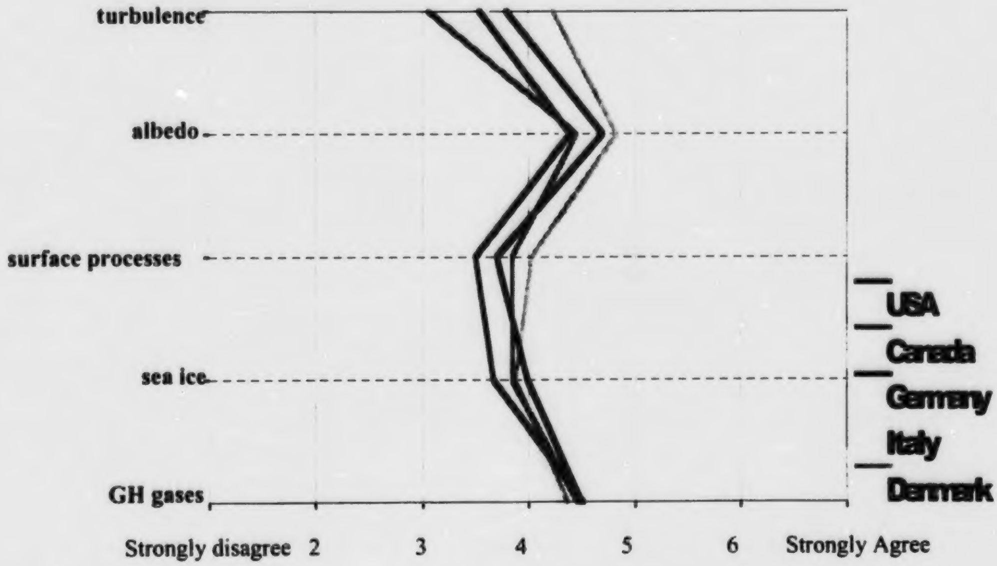
Country	Mailout No.	Return
USA	460	149
Canada	40	35
Germany	500	228
Italy	240	73
Denmark	100	28

FIGURE 1: Scientific Consensus: mean responses

How well do atmospheric climate models deal with the following processes?



The current state of scientific knowledge allows for a reasonable assessment of



are assessed, expressed simply as mean responses from national samples. As Figure 1 indicates, with very few exceptions, there tends to be a reasonable level of agreement among the different scientific communities regarding the abilities of the science. Quite simply, scientists were asked to assess the ability of atmospheric climate models to deal with the processes of hydrodynamics, radiation, clouds, precipitation and atmospheric convection. They were then asked if the current state of scientific knowledge was developed well enough to allow for a reasonable assessment of the effects of turbulence, surface albedo, land surface processes, sea ice and greenhouse gases. One should note, however, that while there appears to be a reasonable degree of international consensus concerning the ability of the science, scientists do not necessarily express an *overly high level of confidence* in these abilities.

The German scientific community then does not differ significantly from the other groups in this study, at least not in terms of the assessment of the of abilities the science. In short, to this point there seems to be a common climate science information base from which all policy interests might draw.

TOWARDS THE SUBJECTIVE

Before getting to the German policy interface it is necessary to determine if differences exist in the 'scientific' transformation of information into knowledge. Again, the same countries are compared, first to demonstrate the level of consensus in the predictive capabilities of the science, which would be pragmatic use to policy makers, and subsequently, to assess the nature of the outcome of climate change.

In Figure 2 it is evident that consensus is towards the *inability* to make predictions, marginally increasing with

FIGURE 2: Assessment of Predictive Abilities: mean responses

To what degree is the current state of scientific knowledge able to make reasonable predictions of:

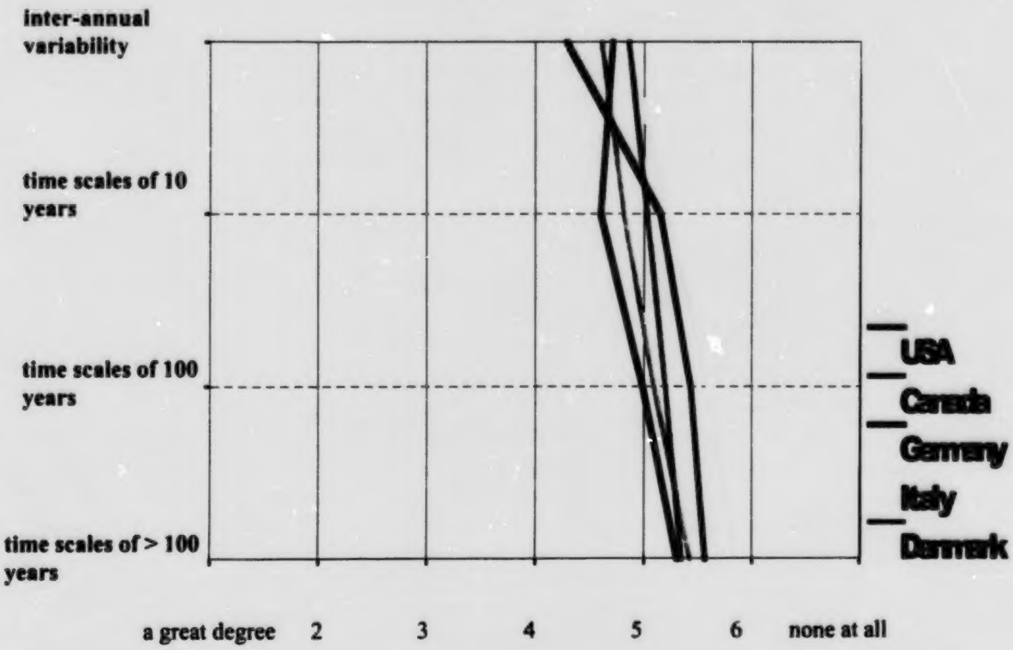
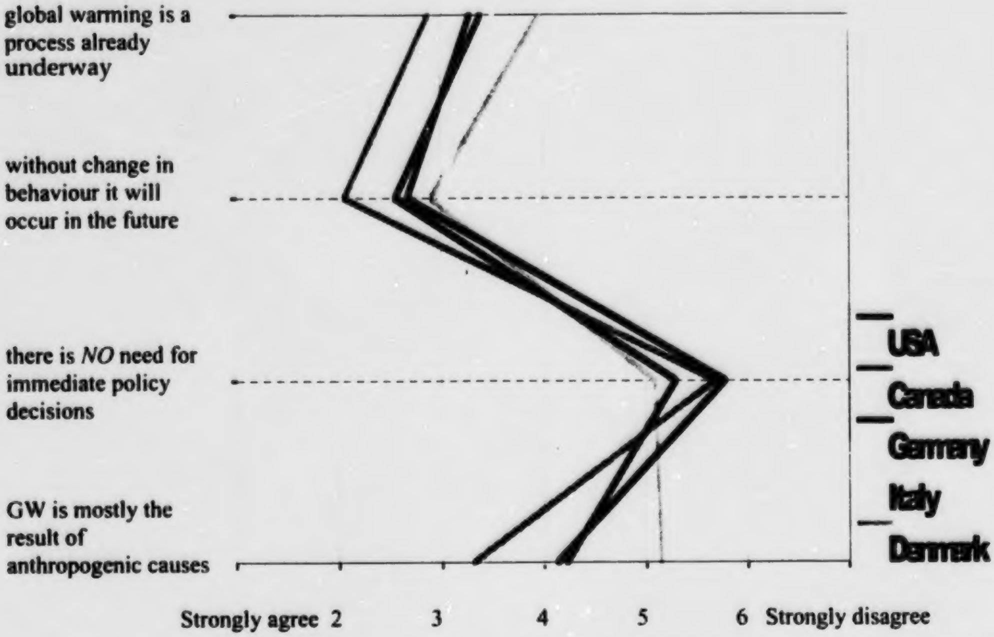


FIGURE 3: Global Warming and Need for Policy: mean responses



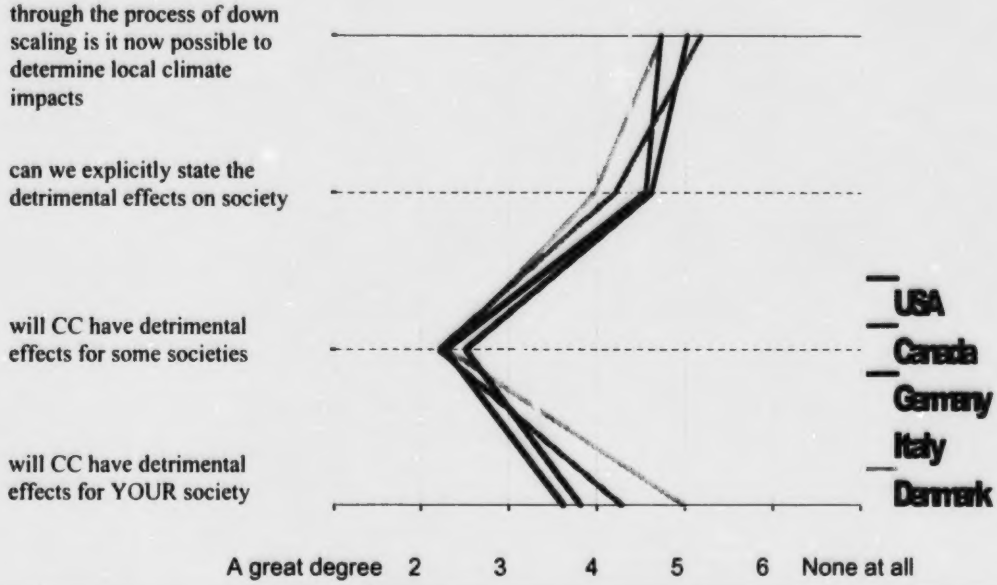
longer climate change time scales. In Figure 3 we can see that even the margin of certainty that global warming is underway does not seem to be overwhelmingly convincing. That it will occur in the future is perceived as a stronger possibility, how far in the future however, remains uncertain (given the results of Figure 2). Furthermore, there is only a marginal attribution given to anthropogenic causes. Regardless of these assessments, there is the perception of an urgent need for the development and implementation of relevant policy. This must act as a source of confusion to those assigned the task of developing policy. Note that, albeit by a very small margin, it is the German scientists who perceive the development of policy to be the most urgent. This perhaps is associated with the fact that German scientists also claimed a better understanding of the interaction of climate and society than did scientists in Denmark, Canada and the USA. Indeed, the scientists of both Italy and Germany demonstrate a statistically significant difference from the other samples included in the project when asked their level of agreement with the statement "Climate scientists are well attuned to the sensitivity of human social systems to climate impacts": mean response for the USA 4.77.; Canada 4.86; Denmark 4.50; Italy 3.38 and; Germany 3.38, where 1 indicates a high level of agreement with the statement and 7 indicates a high level of disagreement with the statement.. However, further analysis suggests only a very marginal relationship (R Square .009) between the claim to understanding the climate-society relationship and the perception of the need for immediate policy consideration.

Nonetheless, assuming the need for immediate policy decisions implies that climate change will have environmental and or socio-economic impacts, otherwise one would have to question the need for policy. (It also ensures the need for continued research.) Since impacts will differ according to region, and policies will need to be implemented regionally, nationally and globally, it is necessary to look at the scientific assessment of the nature of impacts and ability to assess regional circumstances. Findings are presented in Figure 4.

While there appears to be little faith in the ability to determine local climate impacts through the process of downscaling and in the ability to explicitly state the detrimental effects that climate change might have upon

FIGURE 4: Impacts: mean responses

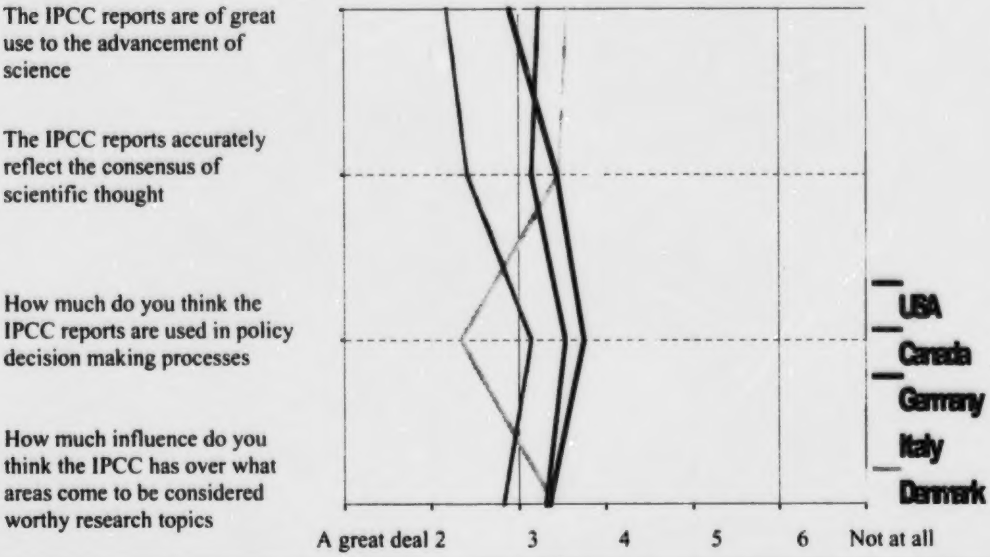
To what degree ...



society, there is a relatively strong belief that the impacts will nonetheless be negative. It is not clear how this is determined. Asked if these negative effects will be experienced by the scientist's host country, the evidence suggests the perceptions that the negative consequences of climate change will be more pronounced elsewhere. Given the fact of the coastal areas and the variety of regional climate types associated with the countries in the study, this interpretation is somewhat contradictory to what would be expected perhaps suggesting vulnerability is only marginally associated with geophysical processes that are isolated from societal relationships, although it is not necessarily made explicit in much of the work addressing global climate change.

One might be led to the assumption then, that the perceived predictive powers of the science would lead to the perception of the need for policy. This too proved not to be a statistically significant relationship. It would seem then that it is perhaps climate/weather events, partial evidence and scientific 'intuition' that leads for demands for policy concerns. However, this might also lead to a less than adequate means of addressing the issue, for example, an imbalance between arguments for abatement versus arguments for adaptation might have dire consequences, particularly if natural ***variability*** plays a more significant role than anticipated or if proposals for emission abatement measures fail. Nonetheless, the climate change issue as it stands *is* mostly an issue of global abatement rather than regional adaptation. Perhaps latently, such a perception is also a means of economic control of developing and underdeveloped nations, a major political consideration in the current process of globalization and 'world' trade. Regardless of possible motives and agendas, the issue of climate change has been addressed predominantly from a global perspective (not of course, without the suggestion of potentially broad regional impacts) and much of the 'global' dialogue draws its authority and credibility from a single source, namely the IPCC. Consequently it is necessary to discuss how the scientific community assesses the IPCC, the international clearing house of climate information (expert knowledge) and the advisory text for national and international agendas. It has come to represent the state-of-the-art of the climate sciences and consequently plays a significant role in international communications and international negotiations. As such, the IPCC could be considered as the information silo of the climate sciences.

FIGURE 5: Climate Scientists' Assessment of the IPCC: mean responses



THE INFORMATION SILO

The IPCC has become recognized as the pinnacle of international efforts to consolidate the results of climate sciences. However, it seems the results are also open to multiple interpretations as is evident in the failure to ratify most climate related agreements. Consequently, climate scientists themselves were asked to evaluate its utility. In effect this will assess if the full scope of scientific opinion is reaching the policy debates at the international level, and the impact of such an institute upon the science itself. These results are presented in Figure 5.

As is apparent, there are less than glowing appraisals of the IPCC. The Canadian science community, it seems, accepts the IPCC reports more than the other scientific communities as being of the most utility for the advancement of science and assesses it more than the other samples as reflecting the consensus of scientific thought. With the exception of Denmark, Canadian scientists also perceive these reports to be incorporated into the policy process more than the other samples and the IPCC as being more influential in directing research. The German science community, the focus of this study, on the other hand, (with the exception of Italy) is the most skeptical of the use of the IPCC reports when it comes to its incorporation into policy decisions. As will become apparent in subsequent analyses, this assessment is not without value. That is, the somewhat negative scientific assessment of the IPCC extends beyond the halls of science and into the halls of German policy as being rated as among the less important sources of information.

THE GERMAN CLIMATE SCIENCE - POLICY INTERFACE

After having located the German science community in the international context, it is necessary to begin to address only the German sample of scientists so as to delineate some of its characteristics. Since we are dealing with the process of science communication it is necessary to address not only the content but also the means of communication. While other means exist, the discussion in this paper is limited to direct communications with the media and direct communications with policy decision makers. Media is included since media is a significant indirect source of information for policy decision makers. (This becomes evident when asking decision makers to rank their sources of relevant information.) Table 2 indicates patterns of communications demonstrating that

TABLE 2: German Scientists' contact with media and policy makers

How much have you been involved with the media?	How much have you been involved with policy makers?							
	very much	2	3	4	5	6	not at all	total
very much		1				2		3
2		2	1	1	3	4	5	16
3	1		3	3	3	8	5	23
4		1	4	*5*	*4*	*7*	*2*	*23*
5			4	*3*	*3*	*14*	*8*	*32*
6			5		*8*	*20*	*16*	*49*
not at all	2	1	3	*3*	*1*	*6*	*62*	*68*
total	3	5	20	*15*	*22*	*61*	*98*	*224*

while external contact is limited, some scientists tend to communicate more with media outlets while others are more inclined to have contact with policy decision makers.

For the purpose of this analysis, the lower right hand quadrant, that is those with values of greater than 3, is designated as the group with low levels of external contact to the political or media ear. Few of the scientists from the German sample claim to have a high level of contact with either the media or policy makers. Consequently it becomes meaningful to make such a distinction in the subsequent analyses. It is also necessary at this point to introduce the political consumer of the scientific information, namely the sample from the German *Exekutive*.

THE SURVEY OF GERMAN POLICY MAKERS

The survey of German policy makers (Krück and Bray, 1998) rather than drawing a sample, addressed the entire population of relevant German policy making departments: 86 ministries at the Bund (federal) level, and 16 from the Länder (individual state) level. The ministries included research ministries, environmental ministries, transport, housing, economics, finance, agriculture, etc. Relevancy for inclusions in the survey was determined by the use of official organizational charts, listing the divisions, groups and departments in each ministry. The charts noted the heads of departments and provided a short description of the department's portfolio. A questionnaire was sent to each person whose portfolio included climate and environmental protection in general. Additionally, official address lists such as the list of German delegates to the FCCC and the list of members on the Interministerial Working Group on CO^2 Reduction were included. The total mail out to members at the Bund (Federal) level was 118. The response rate was 27. This seemingly low response rate is likely influenced by the fact that in some ministries the survey was simply passed on from subordinates to superiors, resulting in one survey representing the views of the entire department. At the Länder level, 399 surveys were distributed and 120 completed surveys were returned. Table 3 indicates the breadth of the interests of the respondents. Multiple roles of the respondents is also a possibility. In short, the duties of the *Deutsche Exekutive* are well integrated into other economic and social concerns. That is, concerns are multiple in most cases.

THE VOICE OF POWER

The political experts were asked about their level of certainty when dealing with the issue of climate change. (In all of the following figures which include the German climate science community and the *Deutsche Exekutive* the distinction is made between government levels: the *Länder* being the more regional (state, provincial) level, and the federal level of government identified as the *Bund*. Further refinement is made for scientists according to high and low levels of contact between science and media, and science and policy.) Concerning the seriousness of climate change both scientists and members of the Executive were asked the same question: "How much do you think global climate change is one of the leading problems facing humanity?", with a value of 1 indicating "very much" and a value of 7 indicating "not at all" as a response. The results for this question are presented in Table 4.

It becomes apparent that the greatest sense of urgency assigned to global climate change is from members of the government, not from the scientific community. Perhaps the increased urgency assigned to the problem of climate change is not the result of employing the state of the art of scientific knowledge, but more to do with the sources of knowledge that government members draw from, or perhaps as a result of concurrent political, social and economic trends.

TABLE 3: Respondents form the German Executive

Duties	# respondents
environmental protection/ecology	45
specifically climate change	19
energy/energy politics/ energy conservation	15
economics	13
traffic	11
research/science/technological transfer	10
forest protection/ forest economics/ forest ecology	9
agricultural economics/ agricultural politics	6
water protection/ water economics	3
regional planning/ land development	5
structural politics/ major principles/ framework	3
coastal protection	2
building/ construction	2
soil protection	2
waste/ rubbish	1
health	1
finance	1
emission protection	1
not disclosed	5

TABLE 4 The Perception Of Climate Change As A Global Social Problem.

How much do you think global climate change is one of the leading problems facing humanity? 1 = very much 2 3 4 5 6 7 = not at all

Sample Group	mean	standard deviation	n
German scientists:			
with high media contact	3.4	1.63	42
with low media contact	3.25	1.63	181
German scientists			
with high policy maker contact	3.25	1.76	28
with low policy maker contact	3.24	1.64	199
International sample of scientists	3.21	1.58	544
Deutsche Exekutive			
Bund	2.8	1.3	120
Länder	2.5	1.5	27

Sources of information for policy makers are by no means limited to those of the traditional scientific community. Other sources of information might include, for instance, internal working groups, and/or, popular media formats such as television or newspapers. In short, there might be competing sources of knowledge in which peer reviewed scientific documents are sometimes relegated to be less than an optimal source of information, or other sources might simply better meet political needs. Consequently it might be that the *Deutsche Exekutive* at times relies on the interpretation of information (expert knowledge into pragmatic knowledge) to be conducted by other, external, means. To assess this possibility, members of the *Deutsche Exekutive* were asked to rate sources of information they considered as being important. These results are presented in Figure 6.

Of particular importance here, given that this paper addresses communication of science, is the fact that at the *Länder* level, daily and weekly newspapers are ranked almost the equivalent to scientific journals as sources of information, and it is precisely at these regional levels that policy, especially adaptation policy, it likely to be put into practice. Given the tendency of the media at times to turn towards sensationalism it is no wonder, as indicated in Table 4 that these regional levels are more likely to perceive climate change policy as most urgent. While the IPCC reports appear to be of importance at the national level of policy, obviously for reasons of international negotiation, they are only marginally significant at the regional level. In fact, 23% of the sample of *Länder* level respondents did not answer the question regarding the importance of the IPCC reports, suggesting perhaps they were unaware of what they are or of their existence, and those that did, rated it as the least valued source of information. This perhaps suggests the need to reassess the role and design of such information silos and perhaps that it is necessary to reconsider the mandates of such international efforts. At the federal level, it appears the most highly appraised source of information is drawn from internal experts and working groups, again suggesting the potential for knowledge to be shaped towards desired political ends.
With this in mind, it is necessary to assess how the policy realm views the issue of climate change when compared to the scientific perspective. Results are presented in Table 5. Both scientists and policy makers were asked if indeed climate change was underway and if it was the result of anthropogenic causes. The results indicate that

FIGURE 6: Sources of Information for *Deutsche Exekutive*

What are your most important sources of information about the climate issue & the atmosphere?

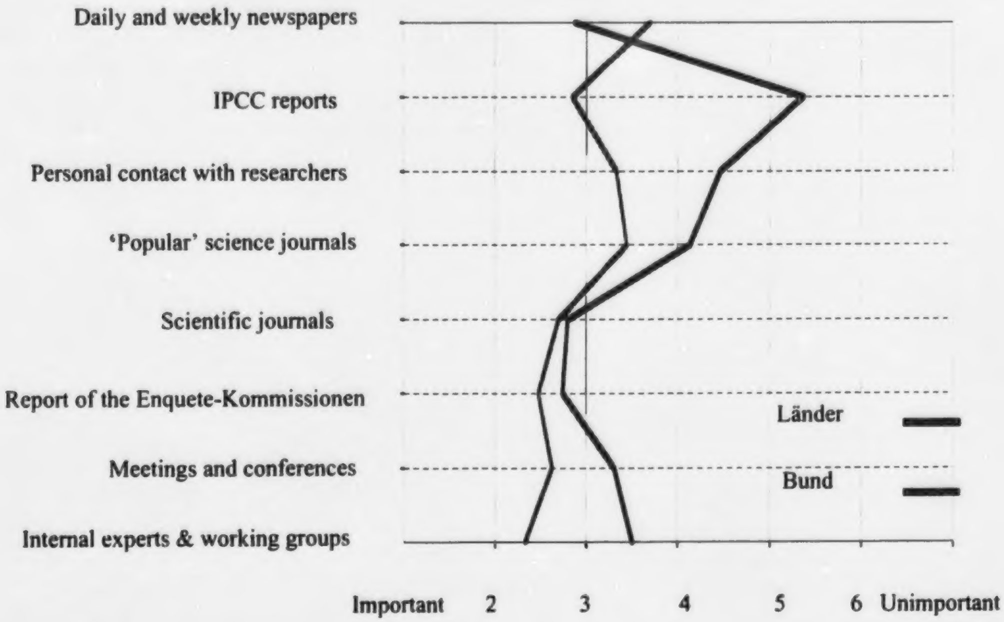


TABLE 5 Is Climate Change Underway and Can it be Attributed to Anthropogenic Causes?

1 = strongly agree 2 3 4 5 6 7 = strongly disagree

	GW underway			anthro causes		
Sample Group	mean	StD	n	mean	StD	n
German scientists:						
with high media contact	3.50	1.77	42	4.15	1.93	41
with low media contact	3.26	1.74	182	4.15	1.90	182
German scientists						
with high policy maker contact	3.36	1.91	28	3.89	2.17	28
with low policy maker contact	3.29	1.73	200	4.19	1.87	199
International sample of scientists	3.39	1.68	542	4.17	1.80	539
Deutsche Exekutive						
Bund	2.63	1.55	27	3.48	1.92	27
Länder	3.00	1.60	120	2.89	1.58	120

policy makers are more inclined than the scientific community to accept that climate change is underway and much more ready to attribute the causes to anthropogenic influences, a cause very compatible with the political needs, that is, a cause and solution in a social and political categorization. It is also a possibility that the message reaching policy and public, by whatever means, might indeed be exaggerated. However, on the one hand, this attribution might emphasize the role of politics (rather than science) in determining political answers to scientific questions. On the other hand, we cannot expect quantified scientific results to provide complete answers for what are essential political questions, as in the case of the climate change issue.

While results in Table 5 also suggest that the decision makers are marginally more convinced than the science on both accounts, that is, that climate change is underway and it is the result of anthropogenic causes, this perhaps, as well as being attributed to sources of information, could also reflect the inadequacy of the science to convey the uncertainties of the scientific evidence. Whereas the scientists consider these uncertainties in making their responses, it perhaps that those in the policy decision making positions either do not understand these uncertainties or are, at the extreme, unaware of them, and perhaps tend to error on the side of caution. Indeed, as presented in Table 6 when scientists were asked about the relationship between science and politics, in particular, regarding the perception of the policy makers use of state-of-the-art information, scientists were in considerable agreement that this is not the case.

This suggests less than an optimal dialogue between science and decision makers, with fault assigned to neither. An assessment of the relationship from the perspective of the decision makers is presented in Figure 7. Here is should be noted that the Federal level tends to perceive the relationship between science and policy to be somewhat better than the perceptions of the regional level decision makers. This, of course, is to be expected since the Federal level of decision makers would be more specialized and united somewhat by the factor of 'federal' concerns, whereas regional administration is differentiated according to the needs of the region. Nonetheless, on all accounts, the relationship between science and politics is perceived of as having much room for improvement. Perhaps increased contact and a more open dialogue would act to introduce the science community to the reality and needs of the political realm and vice versa. This of course, is easier suggested than implemented.

TABLE 6. The Use of State-of -the-art Knowledge

How often do you think policy makers draw on the most current and state-of-the-art knowledge of the climate sciences? 1 = always - 7 = never

group	mean	StD	n
high policy contact	4.30	.99	27
low policy contact	4.42	1.23	196
high media contact	4.32	1.25	40
low media contact	4.41	1.20	179

The less than acceptable claim that the results of science are presented in an understandable manner again points to confusion at the decision making level, perhaps adding to the tendency to consult other than scientific advice concerning the issue. This of course, includes providing understandable details of the uncertainties of the science, as are well noted by the scientists. It would seem it is not a matter of hiding these uncertainties, rather it is a matter of the inability to convey them in a clear manner. Again, this reflects the inability of traditional scientific procedures to translate information (expert-knowledge) into pragmatic political knowledge. It seems too that scientists in general are less likely to conceive of the needs of the decision maker as being overly important, as is likely typical and accepted as practice in basic research. (However, it also might be desirable to maintain a separation between science and politics if one looks at some of the event of recent history.) Nonetheless, the nature of the problem of global climate change is far from typical, perhaps demanding a reassessment of the relationship between science and policy, at least in the context of such post-normal problems. Perhaps one way to overcome these barriers and still retain somewhat of a distance between science and policy would be the inclusion of increased representation of policy personnel and scientific personnel on relevant funding review committees.

Scientists too were given the opportunity to assess the relationship between science and policy. These results are presented in Figure 8. It appears they are even less satisfied with the relationship than are the people working in the policy area and readily admit that they are ill informed as to the needs of policy makers In fact, scientists claim their efforts do little to shape the policy related to global warming and it is more likely that politics is shaping science rather than vice versa. This is particularly evident among those scientists claiming a higher level of contact with the policy decision makers. However, while the scientific community may be prone to the forces of political persuasion, it seems the scientists at the level of the individual do not express a similar susceptibility, although there seems to be an acute awareness of pressure for science to be increasingly policy relevant. These details are presented in Figure 8.

CONCLUSION

The process of communication of complex scientific information to policy makers, that is, the transition from scientific information to socio-political knowledge is a difficult task. This difficulty is compounded when knowledge production is not synchronized with the increasing speed of information production. Indeed the rapid progress of the past decade in the generation of information has led to a knowledge bottleneck. The speed of the production of information is happening within the climate sciences. On the one hand, developments in satellite and measuring devices for example, and increasing computer power have resulted in information overflow in the geophysical analysis of climate change. On the other hand, the current tendencies of social science, has done little for the most part to aid in the process of transforming such information into meaningful social and political knowledge. To undergo the transition from information to knowledge requires intricate patterns of integration and cooperation and the more complex the necessary knowledge, the greater the difficulty of integra-

FIGURE 7 Policy Makers' Perceptions of Science

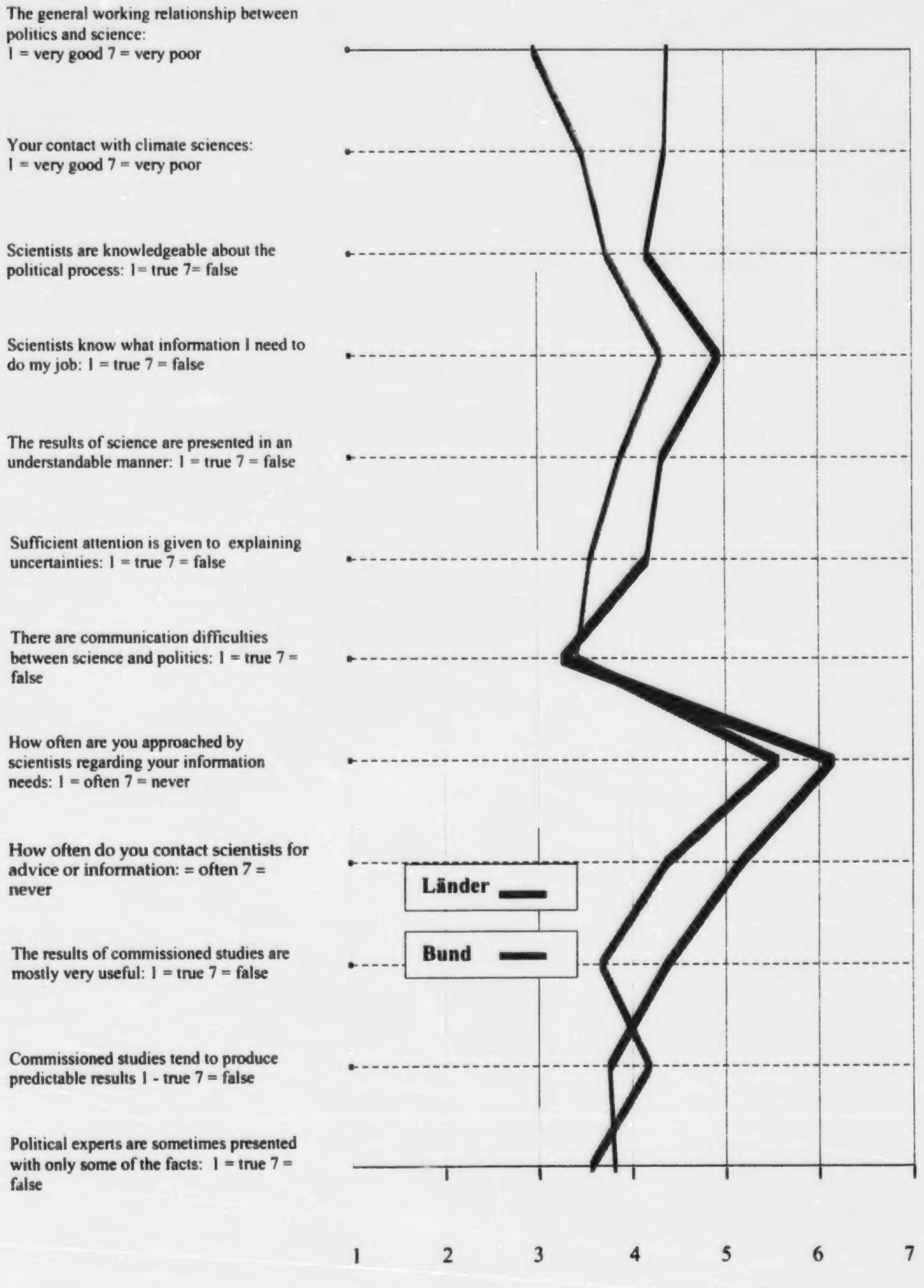
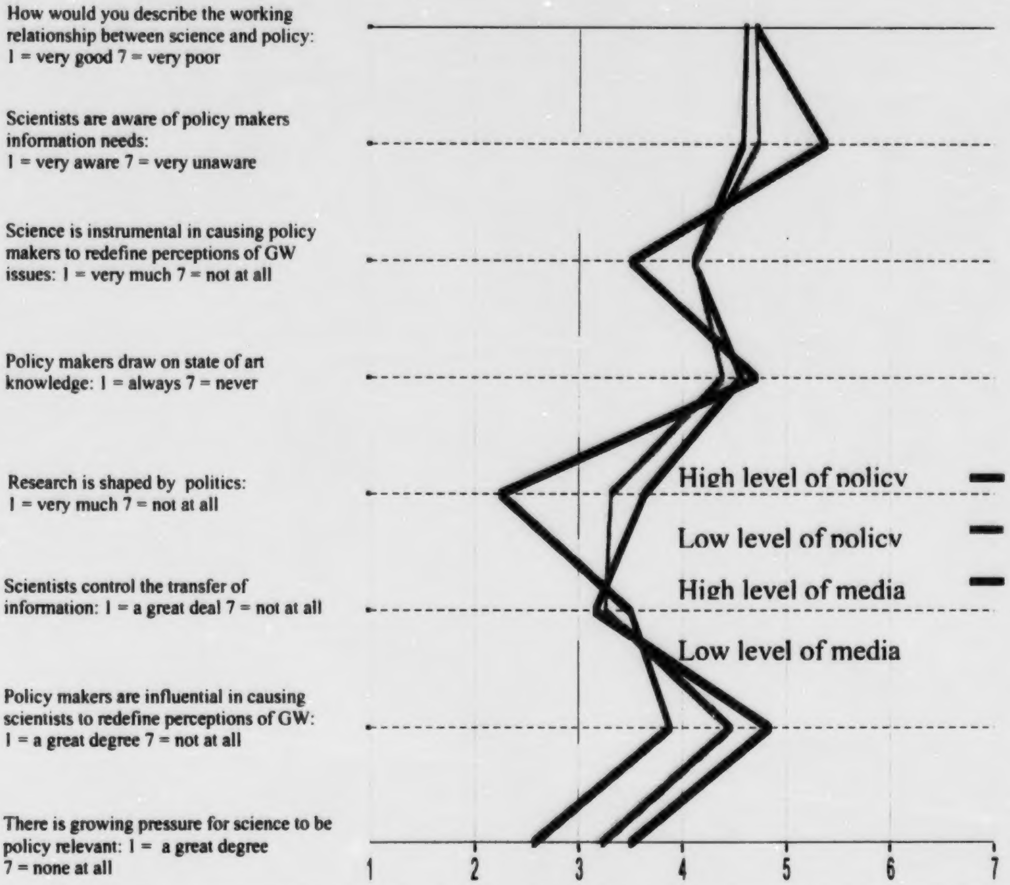


FIGURE 8: Scientists' perceptions of the interaction with policy



tion. For example, as we move from the geophysical climate science towards political and social implications, we move towards territory that is not so easily 'modelled' and a territory that is open to the infinite choices and the influences of human agency. As things stand, "The mounting reliance of everybody in modern society on the judgements of 'experts' is paralleled by the growing ability of many of us, reinforced by modern media, to deconstruct political reassurance couched as scientific or technical 'fact'. This has been the classic pattern in environmental controversies over the past two decades ..." (Grove-White, 1998:50). Under such circumstance both politics and science are at increased risk of loosing their remaining levels of credibility. ❑

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A Survey of Climate Change Beliefs: A Case Study of the Canada Country Study Participants

Linda Mortsch, Brenda Bradley, Jean Andrey, Keith Warriner and Ann Fisher

Most climate change surveys have focused on the beliefs of the public. However, awareness of the climate change beliefs of the "informed" are crucial since they play such an important role in risk communication, policy development and research. This paper summarizes beliefs of participants in the Canada Country Study – a national assessment of the impacts of climate change. The surveys addressed three themes: awareness (e.g., length and frequency of exposure to issue, belief in certainty of climate change), understanding (e.g., climate change causes and impacts) and action (e.g., who is responsible for action). More than 80 percent of the respondents indicated that climate change was "certain to occur" or "likely to occur". Impacts of sea level rise were seen as certain and increases in drought, floods and insect infestations as fairly certain. Perceptions were that negative impacts were likely to occur elsewhere. Respondents felt that they were less well informed about adaptation, limitation strategies and climate change detection but they wanted more information on the consequences of temperature and precipitation changes, social and economic impacts and adaptation strategies. Industry/business and federal and provincial governments were perceived as "very responsible' for taking action on climate change and municipalities the least.

INTRODUCTION

A number of surveys and opinion polls have been conducted about climate change, both in Canada (Fenech, 1992; Synergistics, 1992; Lagace, 1997) and in other countries (Henderson Sellers, 1990; Löfstedt, 1991; Krosnick & Visser 1997). Some surveys asked only about climate change (Jaeger *et al.*, 1993; Bostrom *et al.*, 1994; Mellman Group, 1998) whereas others covered a range of environmental topics (Steel, 1996). Such surveys are organized by large polling firms, government agencies or researchers, and the majority have surveyed the general public (Kempton, 1997; Environics, 1998) although some have targeted students (McDaniels *et al.*, 1996), or 'educated' laypeople (Read *et al.*, 1994). These surveys provide information about the climate change beliefs of the general public, but tell us little about particular stakeholder groups. One important group is the research community - the academics, government scientists, and industry or independent experts who study various aspects of the climate change issue. A literature review found only a few examples (Henderson-Sellers, 1990; Slade, 1990) of surveys directed at the people involved in climate research; none were Canadian.

The Canada Country Study (CCS) was an 18-month national assessment of the social, economic, and ecological impacts of climate change. It focused on twelve economic sectors, five geographical regions as well as a number of cross-cutting themes (Mayer and Avis, 1998; Koshida and Avis, 1998). More than 50 Lead Authors coordinated chapter-writing teams to synthesize knowledge of Canadian climate impacts research. While the CCS provides useful information on what is *known* about climate change impacts in Canada, it says little about scientists' and researchers' beliefs about climate change, including certainty of climate change, causes, impacts, responsibility for action and future information needs. In November 1997, a Symposium was convened to highlight the CCS results (Maxwell *et al.*, 1998). This gathering presented an opportunity to survey CCS participants (Canadian climate change experts and stakeholders) to understand how an 'informed' group perceives climate change. Awareness of the views of the "informed" are crucial since they play such an important role in risk communication, policy development and research.

METHOD

Survey Design

The Mid Atlantic Regional Assessment (MARA) research participants in the U.S. National Assessment developed a national survey that has been applied for climate change perception studies (O'Connor *et al.*, 1999, Bord *et al.*, 1998) and to test alternative "sacrifices" to accomplish reductions in greenhouse gas (O'Connor *et al.*, 1998a). The questionnaire was developed, and pretested with 654 students (Bord *et al.*, 1997) and 106 adults (O'Connor *et al.*, 1998b); it was used for a in pre- and post-workshop analysis and in a national survey of the general public (Fisher *et al.*, 1997).

This survey instrument was modified for use in conjunction with the CCS Symposium. The focus was on questions considered to be useful to climate change research, communication, or policy. Some questions were altered to reflect the Canadian context and idioms. In the pre-symposium questionnaire a series of questions on information needs and perceived responsibility for action were added. The post-symposium questionnaire contained many of the same questions as the first as well as some modified questions, and new topics like research activities, communication methods, and suggestions for future projects or research. The modified pre-symposium and post-symposium survey instruments were pre-tested on a small opportunity sample of Environment Canada staff, and changes were made to improve clarity and flow.

The pre-conference survey, which is the focus of this paper, included 22 closed-ended questions. The survey instrument was designed to provide information on three themes: ***awareness*** (e.g., questions on belief in certainty of climate change, length and frequency of exposure to issue); ***understanding*** (e.g., questions on knowledge about climate change causes and impacts) and ***action*** (e.g., a question on who is responsible for action). A series of demographic questions were also incorporated. This sample of "informed" people may constitute the upper boundary of sophistication to which climate change information is communicated (Read *et al.*, 1994).

Administering the Survey

Two hundred and twenty-eight English and French pre-symposium questionnaires were mailed out two and a half weeks prior to the November 24 – 26, 1997 CCS Symposium. The mailing list was developed by the CCS Secretariat; it included CCS contributors and reviewers as well as interested stakeholders, decision-makers and policy-makers who were invited to the Symposium. People from government, industry, environmental groups, consulting and academia were represented. Respondents were asked to return the questionnaire prior to the CCS Symposium. There was a nation-wide postal strike shortly after the survey was sent out, which could have had a negative effect on the response rate. Symposium attendees who did not receive the survey were able to obtain one at the Symposium and were added to the mailing list for the second survey. Eleven people were added. The second CCS Survey was sent out to 239 people in mid January 1998 and both English and French surveys were available.

RESULTS

A total of 95 people (of 239) responded to the pre-symposium survey, giving a return rate of 39.7% while a total of 87 people responded to the post-symposium survey, giving a return rate of 36.4%. This analysis focuses on the pre-symposium survey.

Respondents

The demographic information collected serves to 'define' the respondents surveyed and compare this group with other samples and surveys. The respondent group can be characterized as highly educated, male-dominated and government-employed the majority of whom live in Ontario. Thus, our sample group is not representative of the general public. Nor is it necessarily reflective of the total expert community, although it does provide insight into a cross-section of climate change impacts and adaptation research community in Canada.

Gender

Eighty-four percent of the respondents were male and 16 percent were female. In previous research, environmental concerns seem to be more widespread among women than men; this may be due to gender-specific value orientations (Samdahl and Robertson, 1989). However, the low number of female respondents precluded this analysis.

Age

The highest concentration of males was in the 46-55 age category. The highest number of females was in the 36-45 age range. The large number of older, mostly male respondents reflects the composition of the main respondent groups – government research, academia, and industry (see Table 1).

Province of Residence

More than 80 percent of the respondents were from Ontario. British Columbia and Saskatchewan had the next representation (8 percent and 6 percent, respectively).

Education

The group was highly educated; 21 percent had undergraduate degrees and 79 percent had graduate degrees. The high education level could reflect the requirements of employment (the majority in government or educational institutions).

It is generally thought that education enables people to gather and understand science-based information about current environmental issues (Jaeger *et al.*, 1993). Generally, the more education a person has, the more likely it is that they have been exposed to scientific concepts, and those concepts help them understand information about climate change. Their scientific literacy may be higher. One survey found that even the well educated (94% of respondents had a university level education and 70% had at least some graduate study) held misconceptions about climate change, particularly about causes of change and personal actions that contribute to the problem (Bostrom *et al.*, 1994).

TABLE 1. Age Distribution of Respondents (in percent)

age	Respondents %
under 25	1
25-35	14
36-45	20
46-55	48
56-65	10
66 and over	7

TABLE 2. Area of Employment

area of employment	%
government	62
industry	8
educational institution	14
private, non-profit organization	5
other	11

TABLE 3. Years Respondents Have Known About Climate Change

years	%
less than 1	0
1-2 years	1
3-5 years	13
6-10 years	27
11-20 years	38
more than 20 years	21

TABLE 4. Frequency of Exposure to the Climate Change Issue.

Frequency of exposure to climate change is…	Respondents %
no contact	0
a few times a year	1
once a month	1
several times a month	7
once a week	11
several times a week	37
daily	43

Employment

Government followed by educational institutions (see Table 2) employed the highest percentage of respondents. Industry and private non-profit organizations were poorly represented. The majority of respondents answering 'other' for their area of employment were private consultants or retirees.

Awareness of Climate Change

Length of Exposure to Climate Change Issue

Respondents were queried on the number of years that they have known about the issue of climate change. Most respondents knew about the issue for 3 years or more (see Table 3). More than 50 percent knew about the issue for 11 years or more. A number of respondents said they remembered the 1970's when the climate change issue was cooling or "the coming of the next ice age".

Scientists have known about the natural "greenhouse effect" of trace gases in the atmosphere since the mid 1800's. In 1896, Svante Arthenius published calculations relating CO_2 concentrations and the surface temperature of the earth, and even estimated that doubling of CO_2 could lead to a temperature increase of 2 to 4°C (Kowalok, 1993). However, scientific attention on the issue was sparse until the mid 1970's when one of the first $2xCO_2$ "enhanced" greenhouse gas forcing experiments with a General Circulation Model (GCM) was published by Manabe and Wetherald (1975). The conference statement issued from World Climate Conference, in 1979, identified the importance of the issue. It has only received major media coverage since the 1988 Changing Atmosphere conference in Toronto coincided with a drought. Respondents who reported knowledge of climate change for more than 20 years would have been exposed to the issue for the longest period possible and have observed the maturation of the scientific information on and society's response to climate change.

Frequency of exposure to climate change issue

One question tested for how frequently respondents heard, saw, or read something about climate change. It was felt that those that had frequent contact with climate change information would be more aware and were gaining knowledge of the issue. About 80 percent of the respondents (75/95) had daily contact or contact several times a week with climate change information (see Table 4). However, this survey was conducted 26 days prior to the Dec. 1-10/97 Kyoto Framework Convention on Climate Change conference. There was daily newspaper, television and radio coverage of the climate change issue that may have affected the frequency of reporting. Due to frequent exposure to climate change, the respondents can be considered well aware of the climate change issue.

What is the Certainty of Climate Change?

One question ascertained respondents' beliefs about the certainty or uncertainty that climate change will occur. Options included the continuum from 'certain to occur', 'likely to occur', 'probable but not proven', 'unlikely to occur' or 'will not or cannot occur'. None of the respondents chose the latter two categories. The majority felt that the climate change was "certain to occur". Table 5 indicates that more than 80 percent of the respondents had a clear belief that climate change was "certain to occur" or "likely to occur". Henderson-Sellers (1990) also reported a strong belief in climate change in a 1987-88 survey in Australia. A strong consensus exists within this group despite the "uncertainty" that is frequently promoted in the media. None of the respondents believed that climate change was "unlikely" or "will not or cannot occur". However, many respondents had participated in the CCS as lead authors or contributors or were identified by the CCS Secretariat as a decision-maker, policy-maker or stakeholder that was concerned about climate change.

How likely is a global temperature increase?

The question "how likely do you think it is that the Earth's average annual temperature will increase by 1.5° Celsius within the next 50 years?" was included as another method to test the belief of the certainty of climate change. However, in this question the description of climate change was much more precise, quantitative and bounded. The amount of change in a climate element, temperature (1.5° Celsius) and the timing of the change

TABLE 5. Respondents' Beliefs on the Certainty or Uncertainty That Climate Change Will Occur.

Climate change is...	Respondents %
certain to occur	53
likely to occur	30
probable, but not proven	17
unlikely to occur	0
will not or cannot occur	0

TABLE 6. Respondents' Belief of the Likelihood of a 1.5°C Temperature Increase in the Next 50 Years.

A 1.5°C increase in the next 50 years is...	Respondents %
very unlikely (1)	2
somewhat unlikely (2)	7
unsure (3)	13
somewhat likely (4)	34
very likely (5)	44

(in the next 50 years) were suggested. Table 6 illustrates that there is less certainty about the occurrence of these specific conditions. Some respondents felt that this condition was "very unlikely" (2 percent) or "somewhat unlikely" (7 percent) whereas in the previous, more general question presented in Table 5 there were no respondents who thought climate change was "unlikely to occur" or "will not occur". Yet, 78 percent of respondents

TABLE 7. Beliefs on Likelihood of Impacts of Average Annual Temperature Increase of 1.5°C Over Next 50 Years (%)

Impacts	Very unlikely (1)	2	3	4	Very likely (5)	n/a
Few problems: people can adapt	32	32	18	14	5	0
Many people's standard of living will decrease	12	15	39	29	5	0
My standard of living will decrease	17	25	35	19	3	1
Many places will experience more pleasant temperatures.	5	14	26	36	15	4
Region where I live: more pleasant winter temperatures	1	7	16	52	21	3
Region where I live: more pleasant summer temperatures	21	37	20	14	5	3
Starvation, food shortages - much of world	5	13	34	32	16	1
Starvation, food shortages - in Canada	44	21	22	11	1	1
Increased rates of serious disease in Canada	16	20	26	34	3	1
My chance of suffering from a serious disease increases	25	17	28	24	4	1
Many places will have more frequent droughts	2	6	15	47	28	1
Region where I live: more frequent droughts	7	17	28	35	12	1
Many places will have more frequent floods	2	11	19	43	23	2
Region where I live will have more frequent floods	9	25	27	29	7	1
Increased rates of serious plant/crop disease	5	13	23	44	13	2
Richer countries will need to increase financial aid to poor countries	3	7	14	45	28	2
Increased rates of insect infestation	1	12	16	48	22	1
Increased numbers of environmental refugees	2	6	14	42	33	3
Many coastal areas will experience sea level rise	0	5	9	32	53	1

still believed that a global mean temperature increase of 1.5° Celsius was "very likely" or "somewhat likely" to occur in 50 years.

Understanding of Climate Change

Impacts of climate change.

Respondents were asked to rate their belief in the likelihood of a series of impacts if the global climate were to increase by 1.5°C over the next 50 years (see Table 7). The statements were written to contrast beliefs on impacts globally (e.g., many places will), in Canada, and personally (e.g., my or the region where I live). Respondents think that the negative impacts of floods and droughts are more likely to occur elsewhere (e.g., many places) rather than in the region where they live. Similarly, their standard of living is less likely to decrease than the general "people's". While respondents recognize there are negative impacts they are more likely to occur elsewhere. Note the difference in the likelihood of serious disease occurring in Canada versus the individual personally suffering from a serious disease.

Over 60 percent of respondents thought that it was "very unlikely" or "unlikely" that there would be few problems with a temperature increase of that magnitude and that people could adapt. Impacts of sea level rise were seen as certain and increases in drought, floods and insect infestations were fairly certain. Respondents also thought that there would be an increase in financial aid to poorer countries and more environmental refugees. More pleasant winter temperatures were reported as likely

How well informed are you about Climate Change Issues?

Respondents were asked to rate (five-point scale from "not at all informed" to "very well informed") how well informed they felt they were about: the science of climate or atmospheric change processes; impacts of climate change; adaptations to respond to impacts; mitigation or limitation strategies to slow climate change; and detection of climate change. Despite reporting three years or more of contact with the climate change issue, do the respondents feel informed about specific aspects of the issue? Where do they feel the most informed? What area is most lacking?

The highest percent (50) of respondents felt they were "very well informed" (rating 5 of 5) on climate change or atmospheric processes (see Figure 1). While the respondents did not feel that they were as "very well informed"

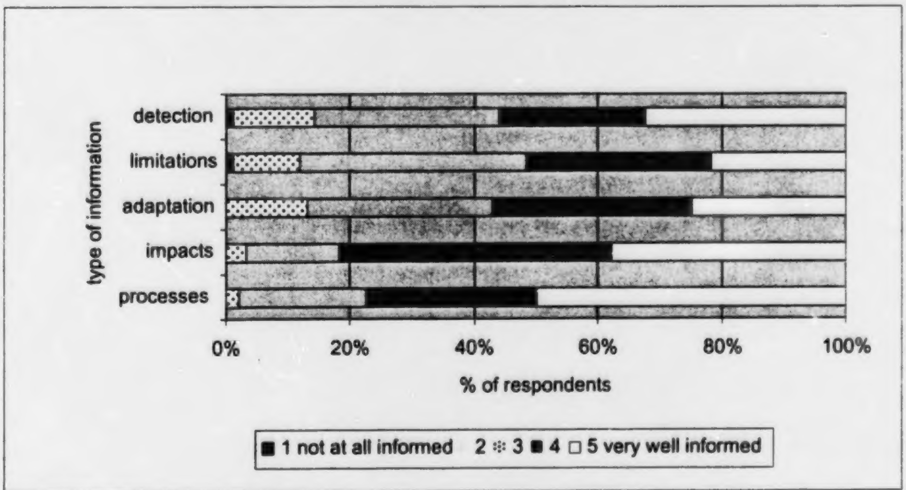

FIGURE 1. How Well Informed Respondents Believe They are on Types of Climate Change Information.

TABLE 8. Mean Scores for 5-point Scale ("not at all informed (1) to "very well informed" (5)) on How Well Respondents Think They are Informed on Some Climate Change Information.

Component of climate change information	Mean score
detection of climate change	3.7
limitation strategies to slow climate change	3.6
adaptations to respond to climate change	3.7
impacts of consequences of climate change	4.2
climate change or atmospheric processes	4.3

TABLE 9. Level of Additional Information for Climate Change Topics Based on Mean Scores for 5-point Scale ("no more information" (1) to "much more information" (5)).

Climate change information on ...	Mean score
scientific background	3.8
model errors & problems	3.6
detecting climate change	3.8
consequences of temperature & precipitation changes	4.3
social, economic impacts	4.1
adaptation strategies	4.2
mitigation strategies	4.1

on impacts or consequences of climate change (38 percent) as the processes, the combined "very well" and "well" informed percentages for both were very high. Adaptation, limitation strategies and climate change detection were where respondents felt they were not as well informed. Mean scores for the five climate change components are presented in Table 8 and reinforce that respondents feel the least informed about detecting climate change and adaptation and limitation strategies.

What more climate change information do you desire?

Are those who feel they are not well informed about the climate issue selecting a desire for more information in the areas that they perceive they lack information? Respondents were asked to rate the level of additional information they thought was required for seven climate change research topics. The five-point scale rated their desire to receive 'no more' information to 'much more' information. Mean scores in Table 9 indicate the greatest desire for more information on the "consequences of climate change" and "adaptation strategies". A more detailed breakdown for more climate change information is presented in Figure 2. Detecting climate change was the component of the climate change issue that the most respondents felt they were "not well informed" (see Figure 1) yet it has the lowest desire for "much more information". It would seem important to receive information on the issue "is the climate changing?" but the respondents did not express as great an interest in that information as other topics. Respondents seem to desire more information on the impacts (consequences of temperature and precipitation changes and social and economic impacts).

This question was adapted from an Australian Study where "Respondents were invited to grade the level of additional information required on various topics on a scale running from 'no more' to 'much more'" (Henderson-Sellers, 1990). The highest desire for more information was for the issue 'social impacts of climate changes', followed by consequences (in precipitation, temperature, etc.), and scientific background. Very little desire was expressed for information relating to measurement or models. The results are similar to the Canadian survey.

What are the Perceived Causes of Climate Change (Human-caused)?

Nine potential causes of climate change were listed to ascertain peoples' beliefs on the causes of climate change. The respondents had to choose whether they were a major cause, a minor cause or not a cause at all of climate

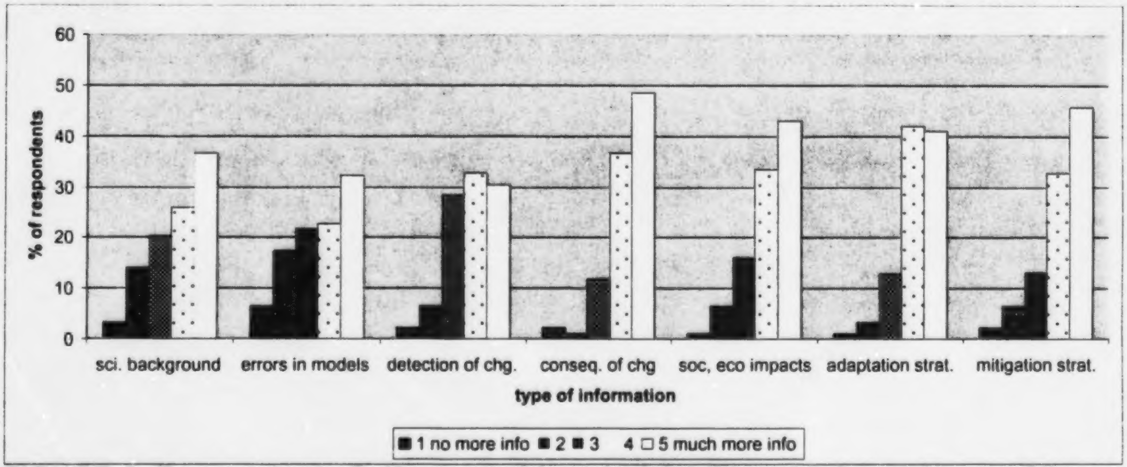

FIGURE 2. Respondents Self-reported Level of Additional Information on Climate Change Topics.

TABLE 10. Respondents' Beliefs on the Causes of Climate Change

Cause of climate change	IPCC review	Respondents belief (%) Not a cause	Minor cause	Major cause
Pollution/emissions from business and industry.	Major cause	0.0	10.8	89.2
People driving their cars.	Major cause	1.1	8.6	90.3
Use of chemicals to destroy insect pests.	Not a cause	67.4	27.2	5.4
Use of coal and oil by utilities.	Major cause	0.0	4.3	95.7
Depletion of the ozone in the upper atmosphere.	Not a cause/minor cause (depending on definition as climate change or global warming)	44.6	40.2	15.2
Home heating and cooling.	Minor cause	4.3	37.6	58.1
Nuclear power generation.	Not a cause	88.2	11.8	0.0
Tropical forest destruction.	Major cause	3.3	31.5	65.2

change. The questions included correct and incorrect statements. Ascertaining the cause of climate change was verified by reviewing Intergovernmental Panel on Climate Change (IPCC) documents (IPCC, 1995).

Most respondents correctly identified industry pollution/emissions; people driving cars; and use of coal and oil by utilities as major causes of climate change (see Table 10). They correctly associated climate change with the use and production of fossil fuels (major contributor of CO_2). The transportation sector (personal vehicles, trucks) is one of the largest sources of CO_2 in Canada. Industrial activity, in particular, primary resource industry is a large contributor of emissions. Residential contribution of CO_2 due to heating and cooling of homes is not as large a source as industrial, transportation or electricity generation.

Eighty-eight percent of the respondents correctly identified that nuclear power generation was not a cause of climate change, while 67 percent identified destroying insects with chemicals as not a cause of climate change. More importantly, depletion of ozone in the upper atmosphere as a cause of climate change had the highest ambivalence between "not a cause" and a "minor cause". Read *et al.* (1994) found misconceptions between the link between the ozone layer and climate change in lay people when 27 percent of respondents thought that depletion of the ozone layer could cause global warming. Significant misconceptions about global change were also identified by Kempton, 1991 and Bostrom et al., 1993. The split between responses may be due to the ambiguity of and lack of detail in the question particularly with this group. The issue of climate change is complex, the science is evolving and knowledge of the issue changes. However, it does identify a significant challenge in communicating climate change; ozone depletion and climate change can be confused. The common misconception is that ozone depletion effects are causally linked to global climate warming. Communicators need to be specific about their definition of climate change.

Action on Climate Change

Who is responsible for climate change action?

The question "to what extent do you believe the following groups are responsible for doing something about climate change?" measures attribution of responsibility for action. Are the solutions a government, individual, industry, environmental non-government interest group (ENGO) or scientist/expert responsibility? Who is perceived to be most responsible? The climate impacts and adaptation summary of the CCS says, "Climate

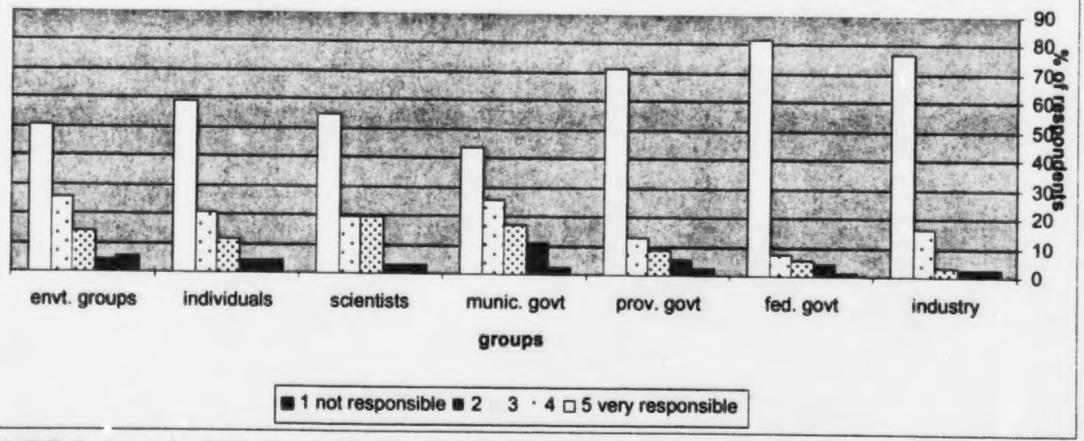

FIGURE 3. Level of Responsibility for Action of Various Groups

TABLE 11. Summary of Respondents Beliefs on Responsibility for Action (Those Who Are Least and Most Responsible)

	Industry	Federal govt.	Provincial govt.	Municipal govt.	Scientists	Individuals	ENGOs
Not Responsible (1 & 2)	4.3	5.4	7.5	13.0	6.5	8.6	9.7
Responsible (5 & 4)	92.5	89.2	83.9	69.9	74.2	79.6	76.3

change is everybody's business. We all need to take responsibility for contributing to the problem and for developing and implementing solutions that work in everyone's best interest" (Environment Canada, Highlights for Canadians, 1997).

Clearly, respondents feel that all groups are responsible for taking action on climate change. Industry/business (76%) and the federal (82%) and provincial (71%) governments are perceived as being "very responsible' by the respondents (see Figure 3). Interestingly, individuals were perceived to have a "very responsible" role by over 59 percent of the respondents. This belies the common statement that the issue is so complex, too distant in the future that individual are overwhelmed by the issue and perceive that they do not have a role in understanding and responding to climate change. This group of respondents believed that municipalities had the least responsibility for doing something about climate change (see Table 11). Yet, municipalities are responsible for transportation planning, public transit, urban planning and development as well as our urban form and structure, which can clearly be linked to having a fundamental impact on emission of greenhouse gases. Municipalities through the 20 Percent Club are showing leadership in developing and implementing voluntary emission reductions.

SUMMARY

The respondents to the pre-symposium CCS survey were highly educated and had at least three years or more knowledge of the issue of climate change. Many reported that they had daily contact with climate change information. Most lived in Ontario. Industry and private non-profit organizations were poorly represented; the majority of respondents were government-employed.

More than 80 percent of the respondents had a clear belief that climate change was "certain to occur" or "likely to occur". None of the respondents believed that climate change was "unlikely" or "will not or cannot occur". Most respondents had participated in the CCS or were identified as a decision-maker, policy-maker or stakeholder that was concerned about climate change. When the description of climate change was more precise and quantitative (1.5° Celsius in the next 50 years), some respondents felt that this condition was "very unlikely" (2 percent) and "somewhat unlikely" (7 percent). Yet, 78 percent still believed that climate change was "certain to occur" or "likely to occur".

Impacts of sea level rise were seen as certain and increases in drought, floods and insect infestations were fairly certain. Respondent also thought that there would be an increase in financial aid to poorer countries and more environmental refugees. While respondents recognized negative impacts, the impacts were perceived to be more likely elsewhere and were less likely to be important personal threats.

Depletion of ozone in the upper atmosphere as a cause of climate change had the highest ambivalence between "not a cause" and a "minor cause". The issue of climate change is complex, the science is evolving and information on/knowledge of the issue changes. Two challenges in communicating climate change are the definition of climate change and the confusion between ozone depletion and climate change.

Adaptation, limitation strategies and climate change detection were where respondents felt they were not as well informed. Detecting climate change had the lowest desire for "much more information". Respondents wanted more information on impacts (consequences of temperature and precipitation changes and social and economic impacts) topics on which they already felt "well informed". They also wanted more information on adaptation strategies.

All groups are accountable for taking action on climate change. Industry/business (76%) and the federal (82%) and provincial (71%) governments are perceived as being "very responsible". Municipalities had the least responsibility. Yet, municipalities can have a fundamental impact on emission of greenhouse gases as they direct transportation planning, public transit, and urban planning and development.

Risk communication is more efficient and successful if it is directed to correcting known gaps and misconceptions and to where people say they would like more information. This survey has highlighted some beliefs of an "informed" group that can be used to develop communication strategies. ❑

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Climate Change Seen Through the Eyes of the Canadian Insurance Industry

Douglas Macdonald

The Canadian insurance industry has a clear economic interest in reduction of property damage caused by severe-weather events associated with climate change. It can achieve that objective by acting in the market or the political arena, or both. In either, it can work toward solving the problem of climate change itself, or its own problem of increasing climate-change liability. Unlike the larger European re-insurers, the Canadian industry has limited its political activity to the latter objective. Understanding the Canadian industry's objective and strategy will inform applied policy making and contribute to the value of "interest" as an explanatory variable for policy analysis.

INTRODUCTION

During the last decade, extreme weather events such as the Quebec ice storm of January, 1998, have imposed significant costs upon those who insure property or crops damaged by ice, hail, flooding or wind. "Every five years or so the costs of weather-related disasters have doubled, with the last three years the costliest in history for the Canadian insurance industry." (Retallack and Bunyard, 1999:61)

The insurance industry has an obvious, self-interested motivation in seeing a reduction in the damage caused by weather events which, many believe, are associated with climate change. This has led a number of analysts to suggest that the industry will become an active participant in climate change policy making, acting in alliance with environmentalists and in opposition to the oil industry. Time magazine pointed to this possibility in 1994.

> These risks and the crucial role played by the $1.41 trillion insurance industry in the global economy could change the dynamic of the debate about global warming. ... In Europe insurance giants have already begun to lobby governments to take action, but in the U.S. the alliance between insurers and greens remains in the courtship phase. ... For their part, environmentalists are praying that insurers will become their corporate Lancelots, challenging energy-industry attempts to sow doubts about global warming. (Linden, 1994)

Environmentalists are not just praying. Greenpeace has launched an active campaign to persuade the industry both to lobby governments in favour of action on climate change and to switch its own investments from fossil fuel to renewable energy. The United Nations Environment Program (UNEP) has also been attempting to co-ordinate insurance industry action along those lines. Writing in 1998, two academic analysts stated their opinion that these efforts might be successful. "It may be possible for tactical alliances between environmentalists, other social movements and the insurance companies (and perhaps other parts of finance, such as pensions and even banking), combined with renewable energy companies and energy efficiency/conservation companies which have clear interests in promoting reductions in fossil-fuel use, to construct a coalition which can legitimize programmes to respond more actively to global warming..." Newell and Paterson, 1998: 696-697).

The Canadian insurance industry, however, has not been persuaded. It has not lobbied Canadian governments to use regulatory or fiscal instruments to reduce greenhouse gas emissions and is not a participant in the current Canadian policy process, co-ordinated by the Climate Change Secretariat.Why has their obvious economic interest not led insurers to take political action on the side of environmentalists?

The purpose of this paper is to attempt to answer that question by providing a review of the actions taken by the European and Canadian insurance industries with respect to climate change. The question is important for two reasons. In terms of applied policy making, we must have as accurate an assessment as possible of the objectives and roles of the players (and potential players) in the process. Our theoretical understanding of policy processes will also benefit by this case-study examination of the way in which the economic interest of a business actor has been translated into a political objective and strategy.

The concept of interest, defined here as being synonymous with "policy objective" is fundamental to policy analysis, regardless of theoretical or ideological perspective. Marxist analysis sees class interest as a fundamental explanatory variable; pluralism, which focuses upon groups or organizations as the unit of analysis more than it does class, some time ago developed the concept of interest groups as policy actors and still finds the question "who benefits?" a useful entry-point for policy analysis; thirdly, rational actor approaches, based in the economist's concept of the marginal utility of the individual, have also taken interest as a basic building block of their method. (Doern and Phidd, 1992; Parsons, 1995) Interest as an explanatory variable – particularly the connections and contradictions between self-interest and contribution to the larger collective interest - is central to policy analysis (Mansbridge, 1990). It is hoped that this examination of the way in which one industrial sector has responded to a threat to its economic interest will contribute to that understanding.

My basic argument is that the Canadian insurance industry is certainly motivated by self-interest with respect to the new problem posed for it by climate change. The inherent logic of the function of insurance in modern capitalist society has led it, however, to pursue means other than lobbying governments to act on greenhouse gas emissions. It is actively lobbying – but to a different end. Instead, it hopes to persuade governments to spend money in ways which will reduce its potential climate-change liability. This case study demonstrates that the concept of interest in policy analysis is far from self-explanatory.

In order to develop that argument in the sections which follow I do the following. The workings of insurance and the historically close relationship between state and market in meeting the societal need to reduce individual risk are set forth. I next review the options available to insurers to address the problem which climate change poses for them. A review is then made of the extent to which the industry has participated in the international policy process initiated in 1992 by the Framework Convention on Climate Change (FCCC) and the actions undertaken by the Canadian industry with respect to Canadian policy.

THE FUNCTION OF INSURANCE

Capitalist societies, by definition, work to increase future wealth by encouraging investment of capital. Investment is essentially a deferral of the consumption of present-day wealth. Such a deferral, by those lucky enough to hold wealth, allows the combination of capital, labour and land to generate future revenue at a rate greater than could be obtained by investment in the form of lending. The larger society, which benefits from this wealth creation, encourages the enterprise by providing the necessary infrastructure, both physical, to allow transportation and communication, and legal, to ensure that buyer and seller can have confidence in market contracts. From its origins in the merchant capitalism of the Renaissance, to penny mining stocks, to today's dot.com economy, there has always been a correlation between rate of return and degree of risk associated with the capitalist enterprise. A society dedicated to wealth creation, such as ours, must necessarily not only provide infrastructure, but also encourage risk taking. One way that is done is by reducing the risk, defined as exposure to future loss, borne by any one individual or firm by spreading the exposure amongst a larger group. Such a pooling of risk is the basic function of insurance.

Infrastructure and risk reduction by means of pooling are similar in that both are public goods. They cannot be provided by means of decentralized market transactions amongst buyers and sellers. They are collective-action problems which require a means other than market exchange for organizing individual behaviour – in other words, they require some form of governance. The point I wish to stress, however, is that this does not mean they must necessarily be provided by the state. Governance and delivery of public goods by bodies other than the state, such as self-regulating professions, the church, charities and co-operatives has a long established tradition and is now the subject of renewed interest as neoliberalism looks for ways to privatize state functions.

The public good of insurance, has also historically been provided privately, dating back to the days when ship-owners first created organizations to pool the risk that their vessel and trading property would be lost at sea. Lloyd's Coffee House began operations as a mutual insurance company in 1688. Privately organized fire insurance dates back to the beginning of the nineteenth century. "In 1809 a group of individuals of Halifax formed the Nova Scotia Fire Association, a mutual organization, which in 1819 was incorporated as the Halifax Fire Insurance Company." (Neufeld, 1972). To this day, life and property insurance are provided by private actors. Other forms of insurance, however, most notably in Canada health insurance, are provided by government. In the United States, on the other hand, health insurance is provided by private actors. Some Canadian provinces directly provide auto insurance, while others do not. There are many other examples of the way in which the public good of insurance can be provided by either the public or private sector.

Although insuring property against damage by theft, fire or, what is of concern here, severe-weather damage, is done privately, government nevertheless plays an essential role. Government regulates the industry, thus providing the legal infrastructure needed by all sectors of the market. It provides services, such as police and fire departments, which reduce the risk to property. It also regulates property owners, in such forms as building codes, which have the effect of reducing the risk of fire or building collapse and thus benefits both property owners and those who insure them.

While governments can either directly insure or take actions to facilitate private insurance, the reverse is also true. Private insurance companies also play a governance role with respect to the activities of those they insure. By inserting conditions in the insurance contract with their clients, the industry plays the same role as regulatory authorities, something which traditionally has been done for fire, boiler and machinery insurance (Sutton, 1991, 38). Some analysts have argued that in the case of pollution, for instance by requiring environmental audits and development of management systems before environmental insurance will be provided, the industry can perform this regulatory role more efficiently than can governments (Freeman and Kunreuther, 1997)

THE INSURANCE INTEREST AND CLIMATE CHANGE

Climate change poses a new problem for the insurance industry because it has reduced the ability to predict the risk of weather-induced property damage.

> Underwriting of property at risk from natural hazards such as windstorm, flood and subsidence is based on the concept of "return periods." Return periods are generally calculated based on observed events and historic claims costs. Rapidly changing climatic conditions will lead to difficulties in calculating return periods and to lagging risk premium adjustments. Unfortunately, the scientific understanding of climate change is not sufficiently advanced for insurers to include such effects in their pricing tools and to develop appropriate new products or services to cope with climate change. (UNEP, 1999)

The mind of the industry is concentrated by fear of a catastrophic event, such as a hurricane hitting Miami with resulting property-damage claims as high as $50 to $100 billion dollars. Insurance analysts recognize that there are a number of factors which contribute to the increased claims they are receiving for weather-induced property damage, such as the increased value of property or increased densities in coastal zones, but climate change is now generally accepted as one important factor (White and Etkin, 1997; Baker, 1998). Since the early 1990s, some parts of the insurance industry, most notably the large European re-insurers, have made considerable effort to draw attention to the financial threat which climate change poses to the industry, and have called upon governments to take action to bring about a reduction in greenhouse gas emissions – working in alliance with environmentalists, as Greenpeace had hoped. (Schmidheiny and Zorraquin, 1998; Leggett, 1999).

In Canada, however, the industry has not made any such public statements and is not represented on the Issue

Tables which have been developing Canadian policy since this country gave a new international commitment to reduction at Kyoto in December, 1997. To understand why that is so, we need to review the options available to the Canadian industry.

How can the insurance industry act to protect its economic interest in the face of this new threat? If it chooses to participate in the policy process, it faces the same two basic options as all other policy makers. It can work to reduce the extent to which the global atmosphere is altered by greenhouse emissions. Alternatively, it can work to adapt to the new reality of more severe weather and try to reduce the resulting damage, through changes in building siting or construction. As a business sector, however, the industry's primary activity is not in the state, but in the market. There, it has two options. It can change the nature of the contracts it offers clients, in terms of coverage or premiums (although as noted above the unpredictability of severe-weather events makes that difficult) and could also use the contractual relationship with the client to reduce its risk, by imposing conditions relating to property design and construction which reduce severe-weather damage. The second market option is to change its investments, from fossil-fuel based industries to renewable industries, as advocated by environmentalists There is, finally, another option. Given the inherent nature of the insurance function, which is performed both publicly and privately, it can work to transfer some of its new climate-change risk exposure to governments.

More important than the distinction between the industry as a market actor or policy actor is the distinction between self-interest and the larger interest. The industry has the option of working with others in the state and market to reduce the threat which climate change poses to humanity as a whole. Or, it can follow a more self-interested strategy of concentrating upon actions, again either as a policy or market actor, which take climate change as a given and limit is own potential liability in this new, hotter world.

As described in the next two sections, European re-insurance companies have taken at least some tentative steps toward solving the problem of climate change itself, while the Canadian industry has concentrated upon its own liability.

THE EUROPEAN RE-INSURERS

1992 marked both the signing of the Framework Convention on Climate Change, at the Rio UNCED conference, and, in August of that year, Hurricane Andrew, the extreme weather event which catalyzed concern in the insurance industry. By that time, representatives of both Munich Re and Swiss Re had published initial explorations of the implications which climate change might have for their industry (Leggett, 1993). In the following year some insurance officials attended two seminars organized by Greenpeace and then in March of 1995 met with Greenpeace and renewable energy representatives at a conference in Berlin, immediately prior to the First Meeting of Parties to the FCCC, held in that same city (Leggett, 1996). Although not pretending to represent the entire industry, some firms, most notably the larger European-based reinsurers such as Swiss Re and Munich Re, have attended all the meetings of FCCC parties, at Berlin in 1995, Geneva in 1996, Kyoto in 1997, and Buenos Aires in 1998. During that time, their participation was formalized through creation of the UNEP Insurance Industry Initiative.

UNEP had originally co-ordinated activities of banks, worried about their new environmental liabilities, and then moved naturally to the insurance industry. By November, 1995, a number of firms had signed the 'UNEP Statement of Environmental Commitment by the Insurance Industry' – a document similar to the earlier statement of the banks, which pledged signatories, in very general terms, to manage their insurance and investment activities in accordance with the principles of sustainable development. The Statement does not, however, go so far as to call upon governments to bring about reductions in greenhouse gas emissions. At a meeting on July 8, 1997, hosted by Swiss Re in Zurich, the Steering Committee Insurance Industry Initiative was created, one purpose of which was to give the industry "a much stronger voice as it promotes environmental considerations in intergovernmental fora' (UNEP, July 8, 1997). Members of the Steering Committee participated in the Kyoto negotiations of December, 1997 and have since called upon governments to ratify the Protocol.

The Steering Committee members are also beginning to explore the option of switching investments to renewable energy, although to date the funds involved are relatively minor (Knoepfel, et al, 1998, p. 13)

THE CANADIAN INDUSTRY

During the 1970s and '80s, the Canadian industry, like that in other countries, had been forced to address the problem of environmental liability associated with pollution. This led the Insurance Bureau of Canada (IBC) to develop, in 1991, a statement of principles on insurance and the environment (Cassils, 1993). In 1993, the IBC formed five ad hoc committees to study and report on what were seen at the time as the five major policy issues facing the Canadian industry – fraud, competition with banks, natural disasters, environmental liability and taxation. Three years later, as attention shifted from pollution to climate change, the Bureau established the Institute for Catastrophic Loss Reduction (ICLR), with an annual budget of $500,000 provided by the industry [Harris, 1998].

The purpose of the ICLR is not to lobby the Canadian federal and provincial governments on climate change policy, but instead to undertake research and education on the subject of natural disasters. This apolitical nature of the Institute is clearly set out in its mandate: 'The Cat Loss Institute seeks to reduce the loss of life and property caused by severe weather and earthquakes through the identification of and support of sustained actions that improve society's capacity to adapt to, anticipate, mitigate, withstand and recover from natural disasters' (ICLR, undated). In 1999, the ICLR was transferred to the University of Western Ontario, with total funding of $3.6 million supplied equally by the university, the Ontario government and the IBC (Rayner, May 10, 1999).

The closest the industry has come to lobbying Canadian governments was a briefing on the insurance perspective on climate change given to federal and provincial environment and energy ministers on September 19, 1997, in Toronto. This special meeting, held during the time that Canada was engaged in internal debate over the position it would carry into the Kyoto negotiations, also included presentations by environmentalists and the oil industry. The following spring, as part of the annual Canadian Insurance Congress, the Canadian industry organized a panel discussion on the subject of climate change. Terence Corcoran, a right-wing newspaper columnist, charged the industry with following the Greenpeace party line, as set out in its 1993 report. Another panel member, Andrew Duglocecki, representing the UK industry, argued that the industry did indeed have an obligation, based on self-interest, to 'lobby on emission controls' (Harris, 1998). The Congress did not, however, pass any resolution to the effect that Canada should ratify the Kyoto protocol.

Instead, the Canadian industry has focussed on "the creation of a national mitigation strategy to invest in actions to improve Canada's resilience to extreme weather and earthquakes." (IBC, April, 1999) Instead of working to prevent climate change, the industry is working to reduce the property damage it causes. Shortly after the Quebec ice storm, the ICLR convened a forum in Ottawa on weather disasters (Canadian Insurance E-News, May 11, 1998). The Institute issued a report on the subject in the fall of that year, and Paul Kovacs called for an effort to "bring government, private and non-profit groups together to plan joint **loss reduction** initiatives." (Canadian Insurance E-News, November 9, 1998, emphasis in original) That proposal was then spelled out in the proposal for a national mitigation strategy put forth by the IBC in April, 1999. The proposed strategy has three elements: (1) expenditure of $100 to $150 million a year by federal and provincial on "hazard mitigation projects" such as the Winnipeg, Manitoba floodway, built in the 1959s; (2) expansion of the Canadian Disaster Financial Assistance Arrangement; and, (3) creation in Canada of a "culture of preparedness." (IBC, April, 1999) In February of this year, the industry called upon the House of Commons Finance Committee to hold public hearings on the proposal. (Canadian Insurance E-News, Feb. 18, 2000)

In keeping with the traditionally close relationship between government and the insurance function, the National Mitigation Strategy is an effort by the industry to protect its economic interest by means of state action. Public funds spent on severe-weather disaster preparedness reduce the potential risk for insurers, just as building codes serve to reduce their fire-insurance risk. The Canadian industry has been just as willing to enter the political arena as the European firms. Paul Kovacs, Executive Director of the ICLR has stated that: "The federal government is going to have to grab the ball and run with it on this one." (Harris, 1998:35). Its objective, however, has been very different. Rather than working with environmentalists to reduce climate-change associated events, it is working with others to reduce property damage caused by those events.

CONCLUSION

To date, Canada and the other parties to the FCCC have not been able to put in place policy measures to reduce fossil fuel consumption and thus stabilize human-caused changes to the global climate (Macdonald and Smith, 1999-2000; French, 2000). There are many reasons for this, but one significant one is the way in which the oil industry views its own economic interest. During the past decade, it has mounted a massive lobbying campaign involving the expenditure of millions of dollars in political contributions aimed at delaying or preventing government action which would reduce consumption of the product they sell (Alternatives, 2000:13) Hilary French, like many other analysts, argues that climate change cannot be successfully addressed, given the political power of the oil industry, until the large firms define their economic interest as consisting of a conversion to renewable energy production. She points to the 1987 Montreal Protocol, the most successful example yet of international policy making to protect the global atmosphere, as having been made possible by the fact that firms such as DuPont, fearful of unilateral American regulation and already launched on a search for alternative products which could be sold into the market created by regulatory action to ban CFCs, came to support the concept of an international accord (French, 2000). In terms of climate change, the one ray of hope she sees is the fact that some of the oil firms have begun to break ranks with the stonewalling campaign of the Global Climate Coalition and are exploring investments in renewable energy: "these companies argue that the effort to replace fossil fuels with new energy technologies will create at least as many economic opportunities as it threatens" (French, 2000: 101).

Although not so central to the issue, the way in which the insurance industry views its economic interest, and the steps it then takes in both the market and policy arena, are certainly significant for the outcome of the present policy climate change policy process. Here, too, there are rays of hope, such as the actions of the European firms discussed above, but in general the outlook is gloomy. Jeremy Leggett, the former Greenpeace official who launched the campaign to woo the industry has written that: "The catalogue of storms, floods, droughts and fires around the world in 1998 exceeded all the weather-related losses of the 1980s. … Still the insurance companies show little sign of being willing to mount a concerted response to the global-warming threat. They surely cannot delay much longer." (Leggett, 1999: 326)

The response of the Canadian industry, however, suggest that the global industry may never take the kind of investment and political action he hopes for. The nature of insurance is such that it has not required any radical departure for the industry to adopt a strategy of shifting some portion of the cost of reducing its potential liability to government. The fact that the Canadian industry has an interest in the success of policy measures to reduce emissions has not led it to take political action to achieve them. Instead, it has followed a different political strategy, one grounded just as squarely in self-interest but with very different implications for climate change policy making.

The interest of a business actor, whether it be a sector, trade association or individual firm, is decided by a combination of external and internal factors. The most important factor external to the firm is consumer demand, followed by regulatory and other forms of pressure brought to bear by governments. The most significant internal factors are corporate culture, defined as the ideas held by senior management, and the organizational structure, which reflects and determines the internal power held by internal units of the firm. Understanding the ways in which these factors combine to determine the policy objectives pursued by a given business is a complex challenge. The Canadian case study presented here shows that interest, and the steps taken to achieve it, are by no means self-evident. Policy analysts who use the basic conceptualizations of interest, ideas and institutions will benefit from an effort to more fully unpack the first element in that familiar triad. ❑

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Engaging Industry in Adaptation to Climate Change: A Perspective from Geological Survey of Canada

Paul Egginton

ABSTRACT

Many businesses currently operate on a five year (or less) planning horizon. As such they have difficulty considering events beyond that time frame. Many companies, however, have longer term planning horizons especially when it comes to the life expectancy of their capital investments. Either directly or indirectly most companies consider current climatic variability in their planning, sometimes considering it in planning for renewable resource use including extraction and renewal or resources (e.g. forests, and fish) and most especially for infrastructure design. This paper discusses the importance of engaging industry now, some of the obstacles and some success stories. ❑

Session A2

INFLUENCES ON PUBLIC UNDERSTANDING OF CLIMATE CHANGE

The Role of the Mass Media in Shaping Perceptions and Awareness of Environmental Issues
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Why Climate Change is Not in the Air: Popular Culture and the Whirlwind Effect
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Same Planet, Different Worlds: The Climate Change Information Gap
Elizabeth L. Chalecki
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Brownlash Communication about Climate Change: An Analysis of Recent Publications by the Fraser Institute
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The Role of Mass Media in Shaping Perceptions and Awareness of Environmental Issues

David Sachsman

"The mass media play a major role in shaping perceptions and awareness of environmental issues. Together with government officials, environmental activists, scientists, and industrialists, journalists and broadcasters set the agenda for environmental discourse and decision-making. The media provide extensive front-page coverage of acute environmental issues such as accidents and spills while often relegating chronic environmental problems - such as global warming and climate change - to the inside pages or the end of the news program. But heat waves and hurricanes usually lead the news, and some reporters are itching to tie such natural disasters to climate change.

INTRODUCTION

The mass media have played a major role in shaping perceptions and awareness of environmental issues since the 1960s. Together with government officials, environmental activists, scientists, and industrialists, journalists and broadcasters have set the agenda for environmental discourse and decision-making for more than thirty years. Before that time, business and industry dominated discussions concerning the effects of economic development on the natural environment. But the publication of Rachel Carson's *Silent Spring* in 1962 changed the frame of environmental discourse among scientists, activists, and government officials, and the rise of television as a national and international medium greatly increased the visibility of environmental issues.

What was the public perception of environmental issues before the 1960s? Neuzil and Kovarik (1996) list William Penn and Benjamin Franklin as early environmentalists and note that America's green crusades were well underway in the 19th century. "One key difference was that many green crusades of the past were likely to be local instead of national in scope," they say, noting that in the past, some "clashes were ignored by the mainstream media or covered only by alternative media" (p. xii).

Before the publication of *Silent Spring* in 1962, environmental groups were largely conservation organizations. "We were taken aback by the speed or suddenness with which the new forces exploded," Michael McClosky of the Sierra Club explained to journalist Philip Shabecoff (1993, p. 118). During the "Lady Bird Johnson years, the watchword became recreation and then natural beauty and environmental quality and all of that." Then came "a whole new agenda." This new agenda - like *Silent Spring* - was all about pollution.

President Lyndon Johnson adopted the language of this new agenda in his February 8, 1965 message to Congress: "In the last few decades entire new categories of waste have come to plague and menace the American scene. These are the technological wastes - the by-products of growth, agriculture and science...Almost all these wastes and pollution are the results of activities carried on for the benefit of man. A prime national goal must be an environment that is pleasing to the senses and healthy to live in" (Burton 1966, pp. 207-208).

Mass media coverage of a number of acute, environmental accidents in the late 1960s provided striking visual images of birds soaked in oil and a river on fire - images of pollution that shaped public perceptions and awareness. "When President Nixon and his staff walked into the White House on January 20, 1969," explained cabinet secretary John C. Whitaker, "we were totally unprepared for the tidal wave of public opinion in favor of cleaning up the environment that was about to engulf us" (Shabecoff 1993, p. 113).

How important was television in forming public perception and opinion? What Rachel Carson had written about in 1962 became a hot news story in the late 1960s at least in part because of the influence of television. The Santa Barbara oil spill was an intensely visual story, as was the fire on the water of the Cuyahoga River in Cleveland. Both were perfectly suited for television.

Oil from an offshore rig had covered the Santa Barbara beaches, trapping and killing the shore birds. College students and other young people had been enlisted to try to save the birds, by hand, one at a time. So night after night, television carried pictures of crying young people with dying birds in their arms. The networks picked this up...and across the continent environmental pollution came to be viewed as a highly personal, deeply involving part of people's lives. The television viewers identified with the young volunteers and felt their pain.

Reporters and editors around the country felt a good news story. Was there a local angle they could cover? Could they find and cover a local environmental problem that would similarly attract viewers and readers? Likewise, the Cuyahoga River on fire (because of chemicals in the water) was a highly visual story with extraordinary shock value. Pollution seemed to be so serious that a river was actually on fire...on the 6 o'clock news. While television generally did not and would not create a specialized environmental news beat - as would many major newspapers - when broadcasters did cover the environment, they put pictures in people's heads and greatly increased public awareness.

Twenty million people came out for the first Earth Day. "April 22, 1970 is as good a day as any to point to as the day environmentalism in the United States began to emerge as a mass social movement," says Shabecoff (p. 113). "The older conservation groups...played little or no role in Earth Day and, in fact, were surprised by the surge of national emotion. Still preoccupied by traditional land and wildlife preservation issues, most - although not all - of the old guard had remained blind and deaf to the growing national anger over pollution and other environmental threats to human health" (p. 118). But they got the point. "In remarkably few years, the fissure between the traditional conservation groups and the pollution- and public health-oriented activist organizations was narrowed and largely - although not entirely - closed" (p. 119). Where in 1959 the Sierra Club had 20,000 members, by 1991 it had 650,000. The National Wildlife Federation had 3 million members in 1990, and the total number of people in environmental groups in this era had risen to around 7 million (Neuzil and Kovarik 1996, p. ix).

Many business leaders viewed the rise in environmental awareness as a threat to industrial development. In 1971, Richard W. Darrow, the president of Hill and Knowlton, the nation's largest public relations firm, told the Economic Council of the Forest Products Industry that business was engaged in a great ecological communications war (p. 11):

> The hour is later, Communications Time than it is Mountain Standard Time, for you and me and our colleagues at the control points of industry. We will do those things that earn us attention and gain us understanding, or we will live out the remainder of our professional lives in the creeping, frustrating, stultifying, stifling grasp of unrealistic legislative restraints and crippling administrative restriction. A public that ought to understand us - and thank us for what we are and what we do - will instead clamor for our scalps (p. 18).

Corporate America appeared to be losing the hearts and minds of the people. The frame of reference of environmental discourse had shifted from the pre-1960s business-dominated emphasis on the need for economic development to the new government perspective of environmental protection and regulation. Industry was lined up on one side and government agencies, activist organizations, community groups, and other institutions appeared to be on the other. Each side was trying to influence the public and legislative agenda by using public relations and other techniques to affect the frame of reference of the mass media. From the late 1960s to 1973, the government/activist frame dominated. Government sources had and have two advantages. They usually supply the greatest number of environmental press releases and they are automatically quoted as "official" sources

(Sachsman 1976). Following the 1973 oil embargo, however, the discussion shifted from the environment to energy, and the balance between economic and environmental awareness shifted as well.

The media's pendulum appeared to be swinging back to environmental concern in the late 1970s when newspapers, news magazines, and television stations worldwide carried the Three Mile Island (Pennsylvania) nuclear plant accident as a week-long front-page story. (Three Mile Island may have been the first environmental news story to attract global attention and it probably played a role in sparking environmental consciousness as far away as Africa.) Why was this story of such interest around the world? Three Mile Island was an impending disaster story. Something bad had already happened and something *much, much* worse might happen. The drama lasted for days and the media kept the story on the front page until it was clear that the danger was over.

Three Mile Island was not the only environmental story to attract attention in the late 1970s. In the Love Canal area of Niagara Falls, New York, the ground was found to contain hazardous chemicals. This was a homeowner story of great human interest that went on and on until the federal government agreed to pay for an evacuation.

Another environmental story in the same time period seemed to receive less news coverage than it deserved. Who outside of Texas remembers the 10.7-million gallon oil spill that resulted from the 1979 collision of the Burmah Agate with another ship in Galveston Bay?

In 1984 viewers and readers across the globe woke up to learn that a chemical gas leak in a Union Carbide plant in Bhopal, India had killed more than 2,500 people and injured tens of thousands more (Shabecoff 1993, p. 268). Two years later the world's worst environmental fears were proved true when the Chernobyl nuclear power station exploded. The Chernobyl disaster changed international perceptions of human risk and fallibility.

The Three Mile Island and Love Canal stories in the 1970s and the Bhopal and Chernobyl stories in the 1980s seemed to set off environmental news cycles just as the Santa Barbara oil spill and the Cuyahoga River fire did in the 1960s. The television networks ran with the big environmental stories and local media followed with local angles. But news coverage was not automatic and when the major national and international media failed to go with environmental accidents - as was the case with a number of major oil spills in the 1970s and 1980s - it was almost as if the accidents had not happened. Then, as in the case of the Exxon Valdez oil spill in Alaska, when television rushed in to cover the story, the environmental news cycle was set off once again. "Of all the damage I observed there," wrote Shabecoff, (1993, p. 179) "none saddened and angered me and millions of television viewers more than seeing seabirds, otters, seals, and other animals coated with viscous oil and struggling - hopelessly in most cases - to stay alive." Exxon Valdez turned out to be a 10.1-million gallon spill, but the story was in the pictures, not the numbers.

Through the years, the mass media, in general, and television, in particular, have provided extensive front-page coverage of acute environmental issues such as accidents and spills while often relegating chronic environmental problems such as shrinking rain forests and leaking underground storage tanks (and harder-to-cover accidents) to the inside pages or the end of the news programs. Journalists and broadcasters look for timely news pegs on which to hang their stories. Accidents and spills not only provide perfect news pegs but also dramatic visual images. Nevertheless, issues of budget and geography sometimes affect television networks, causing them to shy away from stories that are inconvenient for camera crews to get to and cover (Greenberg, Sachsman, Sandman, & Salomone 1989).

GLOBAL WARMING

The term 'global warming' entered the lexicon of the mass media in the 1970s. On July 21, 1997, staff writer Paul Valentine wrote a page-one story for the *Washington Post* headlined "100-Year Trend: Warmer; Confirming What You Feel: Our Summers are Getting Warmer." On February 18, 1978, Thomas O'Toole wrote "Climate Experts See a Warming Trend," telling Post readers that the burning of coal and oil was causing so much carbon dioxide to build up in the atmosphere that by the year 2000, temperatures might begin to rise. This latter story was precisely what is now meant by 'global warming.'

U.S. News and World Report had the story of the "greenhouse effect" on July 25, 1977 in "Energy Use Overheating World." J. Murray Mitchell, "a Government climate expert" was cited along with Wallace S. Broecker of Columbia University (p. 71). Newsweek carried "Long Term Forecast" by Sharon Begley on January 23, 1978.

Four years earlier, *Time* magazine was covering "global cooling." On June 24, 1974 *Time* ran a "global cooling"(p. 86) article titled "Another Ice Age?" citing Columbia University climatologist George J. Kukla. This was followed on May 17, 1976 by "Forecast: Famine?" in which the Central Intelligence Agency worried that University of Wisconsin data was predicting a "Little Ice Age" (p. 86). On September 18, 1978 *Time* ran "Warming Earth? CO2 may change world climate." This article discussed the "warming force of the so-called greenhouse effect" (noting the warnings of a National Academy of Sciences study panel) while reminding readers that others had forecast the coming of a "little ice age." Hoping that "for a while, at least, these two opposites might balance each other neatly," the unnamed author concluded that "the greenhouse effect may well prevail. In that case, it will be a hot time on earth"(pp. 102-4).

NBC Evening News for May 3, 1976 gave 40 seconds near the end of the program to the CIA climate story, emphasizing famine and drought. ABC Evening News for August 25, 1976 gave two minutes 10 seconds to a story that blamed the growth of cities for the drought in England. On September 13, 1976, ABC's Jules Bergman did a two minute 10 second story on a National Academy of Sciences committee report on the damage done by fluorocarbons (from aerosol spray cans) to the ozone layer of the earth's atmosphere. Like most fluorocarbon/ozone stories, this one cited the medical dangers of increased skin cancers, but in this case, the committee said that the most dangerous result might be a warming of the earth's poles. On February 8, 1978, ABC carried a commentary by Harry K. Smith on the debate among scientists between those predicting a new ice age or a warming trend. Smith said he believed in the ice age theory of Wisconsin professor Reed Bryson. The CBS Evening News for April 3, 1980 carried a two minute 40 second story by Nelson Benton on the greenhouse effect based on a Senate Energy & Natural Resources committee hearing. Apparently, neither of the other two networks ran a story on the hearing.

The Vanderbilt University Library has maintained a complete collection of network evening newscasts since 1968. Vanderbilt's online *Television News Archive* contains one-page abstracts describing every single news story. Each abstract includes the story placement, the length of time, the names of sources and reporters, and a description of the story of adequate length and depth to be used in academic research (Greenberg, Sachsman, Sandman, & Salomone 1989). The discussion of network news coverage provided here is derived from Vanderbilt television news abstracts.

The CBS Evening News for March 25, 1982 included a two minute and 50 second story by David Culhane on the greenhouse effect. Chemist Melvin Calvin raised the threat of global warming, Representative Al Gore called for further research, and James Kane of the Energy Department said there was no need for haste. For the mass media, global warming was becoming a chronic environmental issue, like air pollution. It was there yesterday. It was there today. And it would be there tomorrow. Nothing was new. It needed a news peg.

On October 18, 1983, all three U.S. television networks ran two-minute stories on the greenhouse effect, and CBS and ABC placed their stories at or near the top of the news programs. What had happened? The Environmental Protection Agency had issued a report analyzing the impact of the greenhouse effect on the temperature of the earth. CBS and ABC featured John Hoffman of the EPA urging that preparations be made for the future.

The greenhouse effect was mentioned on March 4, 1988 in a CBS story on the ozone layer. On June 23, 1988 NBC linked it to an ongoing heat wave. Anchor Garrick Utley talked about the heat wave and then introduced reporter Robert Hager, who said scientists feared that the greenhouse effect was already occurring. The news peg was a congressional hearing featuring NASA Goddard Institute head James Hansen and his global temperature chart. Hansen said 1988 already was the hottest year ever. Woods Hole Research Center scientist George Woodwell predicted a warmer climate.

The Inside Sunday edition of the CBS Evening News for June 26, 1988 featured a very unusual eight-minute environmental story that led with the greenhouse effect, linking it to the high temperatures of the 1980s. The Goddard Institute's David Rind and climatologist Thomas Karl warned of future warming and discussed the need to decrease the production of carbon dioxide. ABC did the greenhouse effect story in a four-minute piece on July 27, 1988.

Three scientists and an environmental activist were featured, all very worried about the greenhouse effect. Two of the sources were NASA scientist James Hansen and Woods Hole scientist George Woodwell, both of whom had spoken before Congress in June and had been featured on NBC at that time. The third was Michael McElroy of Harvard University.

The NBC Evening News for October 12, 1988 mentioned global warming as a Campaign '88 political issue. ABC mentioned it in a November 14, 1988 segment on important issues. All three networks on May 8, 1989 did greenhouse effect stories based on Senate sub-committee hearings in which NASA scientist James Hansen told Senator Al Gore that he had been ordered by the Bush administration to change the conclusions in written testimony regarding the seriousness of global warming. On May 12, 1989, CBS reported that President George Bush was endorsing a proposed global warming treaty and ABC said that President Bush wanted the U.S. to take the lead in solving global warming. Both networks repeated Hansen's statement that his written testimony had been softened by the administration, and ABC included a comment by Gore that Bush had been dragged slowly to the right position.

CBS on July 8, 1989 mentioned global warming in an economic summit story, and ABC on August 24, 1989 carried comments on global warming by actor Robert Redford. The CBS News for September 19, 1989 as part of its Hurricane Hugo coverage carried a story by reporter David Dow that scientists were predicting that the greenhouse effect would play a role in creating stronger and more dangerous hurricanes in the future. Meteorologist Kerry Emanuel presented the theory. Scientist Michael McElroy said action was needed to curtail global warming. Robert Livezey of the National Meteorological Center disagreed with the theory.

Global warming is a chronic environmental issue. It is a long-term problem that was about the same last year as it is this year. It measures temperature changes across decades. It is a stretch for scientists to say that the greenhouse effect is responsible for higher temperatures in a given year or even decade and it is an even bigger stretch to propose a theory linking global warming to the intensity of hurricanes. Journalists are always looking for good news pegs. In the 1970s and through most of the 1980s, global warming and greenhouse effect stories were usually chronic environmental science features or government, political, or congressional hearing stories. But scientific discussions and government meetings on global warming are neither visual nor dramatic news pegs. In the 1980s some scientists seemed to be linking the greenhouse effect to current high temperatures. If this were true - and even if it wasn't - it gave some reporters a reason to link global warming to the acute, front-page issue of heat waves.

Coverage of global warming increased enormously in the 1990s. The three television networks carried around one hundred news stories about global warming from 1990 through 1999 judging by a count of global warming abstracts from the Vanderbilt News Archive. This compared to a handful of related stories in the 1970s and about twenty stories in the 1980s, using the same measure. Global warming was an international political story in the 1990s with the United Nations Earth Summit in Rio de Janeiro, Brazil in 1992 (featuring the signing of the UN global warming treaty) and the Kyoto, Japan global warming conference in 1997. The NBC Evening News of March 29, 1990 carried a 30-second report that NASA scientists said "that there has been no long-term global warming" (Vanderbilt University), but such doubts were not the norm on the nightly news.

The ABC Evening News for June 16, 1990 carried a story on the search for a link between the greenhouse effect and the thinning of the ice in the Arctic. On December 20, 1991 CBS reported that concern existed that global warming may be shrinking the Antarctic ice pack, possibly endangering penguins. ABC on February 27, 1995 covered British scientists who blamed global warming for the creation of a giant Antarctic iceberg. The cracking Antarctic ice shelf also showed up on cable television in a February 5, 1997 global warming story on CNN.

NBC did a heat wave story on July 22, 1991 in which Dr. Michael Oppenheimer of the Environmental Defense Fund brought in the greenhouse effect. The network reported the possible connection between global warming and recent extreme weather patterns on July 8, 1996 and again on April 7, 1997 (in a Washington, D.C. story by Robert Hager). NBC covered one hundred television weather forecasters on October 1, 1997 who were invited to the White House for a briefing on global warming policy. By this action the Clinton administration appeared to be linking the greenhouse effect to today's weather.

NBC's Robert Hager reported from Washington on January 8, 1998 that 1997 had been the hottest year on record. National Oceanic & Atmospheric Admiral Tom Karl and government meteorologist Joe Friday blamed global warming. While ABC was going with the Antarctic ice block news peg (in an April 17, 1998 story), NBC, CBS, and CNN ran stories on April, 22, 1998 about a report that the climate had been warming since the 1400s. NBC explained the greenhouse effect, CBS linked the temperature increase to the industrial revolution, and both NBC and CBS included University of Massachusetts scientist Michael Man talking about how hot the weather was getting. On May 9, 1998 CNN covered a Worldwatch Institute report linking drought and hot weather to the greenhouse effect.

The global warming Arctic Circle news peg was worth a trip to Ice Station Sheba for reporter Jerry Bowen and a two-part story (May 27 and May 28, 1998) for CBS. Meanwhile NBC was showing underwater scenes from the Great Barrier Reef in a May 31, 1998 story connecting dying coral to global warming. On June 8, 1998 NBC, CBS, and CNN covered a government report on global warming and on El Nino-related weather patterns. La Nina was mentioned. All three networks carried Vice President Gore, who compared or connected El Nino weather and global warming weather. ABC joined in on July 14, 1998 explaining the impact of global warming as part of a four-minute story on the current nationwide heat wave. It had been the "hottest June in recorded history" (Vanderbilt University). In the fall, NBC (October 20, 1998), CBS (November 2, 1998), and NBC (November 15, 1998) carried Arctic global warming stories and on March 4, 1999, CBS did a Greenland ice cap global warming report.

Where once global warming had been treated predominantly as a long-term chronic environmental issue that was generally unrelated to specific events other than scientific announcements and government meetings, by the late 1990s, the television networks, at least, regularly were linking the greenhouse effect and global warming with current, event-oriented news pegs such as heat waves and melting polar ice. In 1999, most of the network news stories on global warming carried a current event-oriented news peg such as: the warm weather of winter 1998 (CBS June 2, 1999); the effect on insects and natural disasters (CBS June 24, 1999); higher temperatures and more extreme weather (NBC and CBS June 29, 1999); and melting ice (ABC December 3, 1999). Network television news stories generally appeared to accept the existence of global warming as an every day phenomenon that can be measured in terms of current weather conditions. On July 31, 1999, however, CNN environmental reporter Natalie Pawelski reminded her viewers that there were scientists on both sides of the heat wave question by including Jim St. John of Georgia Tech, who "says heat waves alone are not evidence of global warming" (Vanderbilt University).

Does global warming affect hurricanes? On May 11, 2000 Associated Press reporter Randolph E. Schmid used a form of journalistic reverse English to tie hurricanes to global warming: "While some climate experts have been blaming the increase in tropical storms in recent years on global warming, [Bill] Gray [of Colorado State University] says the trend is cyclical and not related to warming" (p. A3).

Is global warming now an acute environmental issue, the cause of heat waves and other natural disasters? Tune in at 6 o'clock for the story. ❑

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WHY CLIMATE CHANGE IS NOT IN THE AIR: POPULAR CULTURE AND THE WHIRLWIND EFFECT

Shelly Ungar

This paper begins with the knowledge ignorance paradox, a consequence of the "knowledge society" that implies that scientific ignorance among the public is the natural state of affairs. Departures from ignorance are linked to two phenomena. First, public grasp of an issue depends on bridging metaphors that link it to ideas and images prevalent in the popular culture. Second, public grasp depends on a "whirlwind effect." A cultural whirlwind involves a rapidly evolving and progressive sequence of unexpected and forceful events that create a vortex that hurls through a variety of arenas with a strong conversational and practical presence.

INTRODUCTION

Since the "Greenhouse summer of 1988" briefly put climate change at the top of the public agenda (Ungar, 1992), the issue has mostly lingered on the sidelines. A recent study undertaken by Environmental Defense reveals that concern for "global warming" falls well below that of various other environmental issues (Environmental News Network Staff, 2000). Given the accumulating scientific evidence and associated real world events-global temperature records, strange weather events and record insurance losses, the calving of massive icebergs from Antarctica-this relatively low level of concern is troubling. But not only do respondents underestimate the significance of climate change, they miss a remarkable government and public success story over the past 30 years. Despite evidence that significant progress has been made in many areas, a majority of respondents believe that problems like pollution are worse today than 30 years ago. Finally, over 80% of respondents believe that individual actions and public education are the most powerful tools to tackle environmental problems.

These responses are problematic and give rise to our first theme. Specifically, scientific ignorance is an embedded and expectable feature of our ostensible knowledge society. Ignorance in this context is not just a presupposition, but a social fact that can be deduced, observed and explained. Indeed, the theoretical unfolding of what is termed the "knowledge-ignorance paradox" implies that pockets of observed public knowledge of science are exceptional and require specific explanation.

Our second concern is to identify conditions under which scientific ideas appear to breakthrough the veil of ignorance. Drawing on the ozone hole, Ebola Zaire and recycling, we suggest that departures from ignorance depend on a whirlwind effect-a rapid succession of events that can sweep people up in an almost irresistible way. To achieve a public breakthrough, an issue must acquire a life of its own; verily, a replicating life. The issue must be linked to bridging metaphors in the popular culture and attract and subsume a range of related ideas and practices. It is this broad convergence that renders an issue memorable and sticky. Climate change fails to meet these criteria and remains in a public limbo.

THE KNOWLEDGE-IGNORANCE PARADOX:

While the idea of an "information society" has became a master metaphor of our time (Martin, 1995), there is an underside of this transformation that requires examination. That there has been a rapid proliferation of scientific and technical knowledge, as well as other forms of data and information, is incontestable. But this information explosion and the associated revolutions in technology imply-and in fact necessitate-an increase in the social distribution of ignorance. Here we use the concept of a "knowledge-ignorance paradox" (KIP) to capture how the growth of specialized knowledges implies a simultaneous increase in ignorance (Ungar, 2000). Lukasiewicz

(1994: 122) observes that with the exponential growth in the volume and complexity of information one's degree of grasp (the ratio of information the human intellect can handle to the volume of information available) "is quickly diminishing while one's [degree of] ignorance is on a fast rise."

The starting point for grasping the specialized KIP is the proliferation of knowledge at work (drawing a sharp distinction between an extant knowledge economy and a far more hypothetical knowledge society). So great has been this proliferation that typologies of "information occupations" are so extensive as to be uninformative (Martin, 1995: 95-99) There has also been a "technization" of work, whereby computerization leads to increased emphasis on the creation and manipulation of symbols (Barley and Orr, 1997). As information pervades the economy, many specialty domains face an exponential growth in the volume and complexity of information. By implication, experts are becoming more ill-informed about related or intersecting knowledge domains.

Role incumbents in specialized knowledge domains may well feel besieged, although the extent of this depends on the strategies used to manage information pressures. Despite expectations that experts should "keep up," a poll of family physicians revealed that 64 percent did not know that the symptoms of heart disease differ in women and men (Hearst News Services, 1996). Rather than falling behind, a more general strategy is to increasingly constrict defined areas of specialization. What was noted about physics in the 1940s-professional talk could not be conducted with colleagues in adjacent offices-now extends to other realms of knowledge (including sociology).

Assuming that human information processing capacity is more or less fixed, the specialized KIP predicts a decline in the stock of general knowledge. Besides the specialization pressures that can besiege occupational role incumbents, increases in the volume and complexity of information escalate the *entry costs* to virtually every *other* knowledge domain. Research on the knowledge gap hypothesis reveals that prior knowledge in an area is critical to assimilate new information in that area (Viswanath and Finnegan, 1996). Starting with conceptual anchors, the gaining of knowledge in a field tends to follow a spiral model, with new bits added to prior accumulations. But as proliferating conceptual anchors and technical terms (or what librarians call "twiggings"), are overlaid with new facts and frequent revisions, specialty knowledge domains become forbidding to outsiders. All but the most persistent non-specialists are effectively precluded from keeping up. In this context, there is evidence that informational pressures are causing reactance, captured in the research on "reading reluctance" (Royce, 1997).

SCIENCE ILLITERACY AND THE ATTENTION ECONOMY

Scientific ideas and results are encoded in a distinct language and need to be decoded to be accessible to the public. Thus high entry costs-among other things-militate against the acquisition of scientific knowledge. Scientific literacy for citizens is generally defined in terms of three criteria: understanding the scientific approach; understanding basic scientific concepts; and understanding scientific and technological policy issues. The preponderance of evidence suggests that the public performs poorly on all three criteria, with five to fifteen percent qualifying as scientifically literate (Shamos, 1993). Research that examines scientific knowledge on a pragmatic, need-to-know basis also reveals a limited grasp of key facts. Thus many parents still believe that a tan is healthy, and 24% never apply sun tan lotion to their children (Dente, 2000). All of these findings are worrisome and typically lead to questions about the adequacy of the education system.

The specialized KIP provides a more socially embedded explanatory approach to scientific illiteracy. Rather than educational deficiencies, the KIP focuses on the role of institutions, technology and the popular culture in the social construction of ignorance and the leveling of social expectations for knowledge. Since this analysis is developed elsewhere (Ungar, 2000), only the main ideas are presented here.

If the specialized KIP imposes high entry costs to (non-work) knowledge domains, there is at least one exception-and a decisive one at that: the popular culture. As a result of the simultaneous and often symbiotic maturing of a number of technologies-television, video, computers, the Internet-the icons, celebrities, images, and brands that constitute the popular culture are now so prominent, omnivorous and relentless that they can be considered hyper-realities. Through a combination of technology and social organization, "the urban surface is a continuous screen, or a series of overlapping screens" onto which the elements of popular culture are projected (Dewdney, 1998: 95-96). These representations are available to everyone, even highbrows who disdain them (Peterson and Kern, 1997).

Through its relentless presence, the popular culture serves as a ready-made, comfortable, and relatively non-threatening resource for conversation. Virtually everyone can join in the discussion, leaving "experts" without any trump card. In this context, Collins (1974: 114-152) underlines how much of social interaction is made up of and depends on ongoing conversation. Social structure is animated, realized and reproduced in talk. And despite protestations that the popular culture is debased, trivial or short-lives (e.g., Hirsch, 1997), it provides the connective threads of information and conversation that tie us together. For example, several studies show that knowledge of AIDS soared with admissions by Rock Hudson and Magic Johnson (e.g., Kalichman, 1994).

In contrast with the impact of the popular culture, the institutions charged with the task of upholding the model of the "well-informed citizen" have been increasingly under assault in recent years. Museums and galleries, libraries, public broadcasting, the arts, and universities have suffered deep cutbacks in public funding (Webster, 1994: 206-223). Knowledge specialization has largely driven the public intellectual out of business (Jacoby, 1987). While anti-intellectualism is not new, it has reasserted itself in more virulent form. Public resentment appears to have increased as more power and wealth have accrued to a small elite with highly specialized and valuable knowledge (Newman, 1995). When this resentment is coupled with a growing distrust of politicians, the media, public institutions, and many experts, it further diminishes the social value the of "truth" and the obligation of being knowledgeable (Shermer, 1997). Digital technology not only undermines the distinction between the real and the unreal, but the Internet teems with so many competing claims that the public has little basis for assessing evidence.

Science is poorly equipped to compete in the knowledge economy built around the popular culture. As an encoded form of knowledge, scientific understanding occasions high entry costs and speech barriers. Gaining a passable level of scientific literacy is time consuming and challenging. What people often lack is the motivation, a payoff for the efforts to gain literacy in a scientific domain. Conversationally, there is little return for being scientifically informed. Thus there is evidence suggesting that scientific acumen does not impress others, while little public shame attends admissions of ignorance (Ungar, 1981). Complexity and uncertainty, what often amounts to a "bad news" syndrome, and the greater attractiveness of other, more leveling topics, place a heavy burden on anyone trying to maintain conversational interest on most scientific topics. But most is not all, and here we contrast the divergent public receptions of the ozone hole and climate change.

ACHIEVING BREAKTHROUGHS IN SCIENTIFIC UNDERSTANDING

Sufficient similarities characterize the ozone hole and climate change that they afford comparisons akin to a natural experiment (Ungar, 1998a). Overall, the evidence suggests that the ozone hole achieved a breakthrough in the public understanding of the basic science and policy issues while climate change did not. People generally confound the latter with the former:

> ... our results are consistent with Kempton's claim that "the ozone hole has arrived as a concept in the US public's consciousness, but the greenhouse effect is entering primarily as a subset of the ozone hole phenomenon, the closest model available" (Bostrom et al., 1994).

At the policy level, concern over the ozone layer generalized to action, as Americans supported various boycotts. With climate change, Kempton, Booster and Hartley (1995: 131) observe that "lay informants had virtually no knowledge of the policies for global warming actually being debated." Public pressures have steadily eroded conservation measures stemming from the two oil crises, and the fastest growing segment of vehicle sales is in low-mileage vans, SUVs, and pickup trucks.

The greater public understanding and response to ozone depletion requires explanation. One obvious explanatory candidate-the amount of media coverage-is **not** decisive here. In direct contrast with the agenda-setting hypothesis, data reviewed by Ungar (1998a) reveal that over the peak of their overlapping issue attention cycles (1987-1991), climate change secured significantly more media stories, Congressional hearings, and public statements by prominent scientists and scientific organizations than did the ozone problem.

Since the arrival of the ozone hole in the public consciousness is an anomaly in the broader context of demonstrated scientific illiteracy, it is necessary to provide an account of how it broke through the veil of ignorance. Here we use the metaphor of a whirlwind-a rapid and concatenating series of events with a potential destructiveness that irresistibly sucks people in. For a whirlwind to develop, it appears that an issue must be blessed with bridging metaphors to the popular culture allied with spiraling sequences of events that people encounter in an irresistible and concrete way.

BRIDGING METAPHORS

The signal advantage of the ozone hole is that it can be encapsulated in a simple, direct, tightly coupled and widely familiar "penetration" metaphor. Stated succinctly, the hole leads to the increased bombardment of the earth by lethal rays. The idea of rays penetrating a damaged "shield" meshes nicely with abiding and resonant cultural motifs, including "Hollywood affinities" ranging from the shields on the Starship Enterprise to Star Wars. That the threat can be linked with Darth Vader means that it is encompassed in common sense understandings that are deeply ingrained and widely shared. The penetration model is ubiquitous in video games and children's television shows. It is also allied with a theory that has captivated the publics' imagination: the claim that an asteroid striking earth the caused the disappearance of dinosaurs (Clemens, 1986).

The key to favorable bridging metaphors is to provide the resources for lay theorizing. If a popular cultural template affords an appropriable theory, an "object-to-think" with or that can "played with"-as in Freudian analysis of dreams-it has the capacity go beyond the scientific domain and to capture the imagination of the public at large (Turkle, 1999). This is underscored by evidence indicating that people learn more from others than from any other source of information (Freudenberg and Pastor, 1991). It is conversational presence, encompassing things like talk radio and informal talk related to mundane practices, rather than media coverage per se, that what can put an issue in the air and let it acquire a life of it own.

THE WHIRLWIND EFFECT

The greater comprehensibility of the ozone hole would not have mattered if the issue was not caught up in a cultural whirlwind. The attention economy suggests that people are highly selective in the information they take time to process. Bridging metaphors linked to the popular culture afford an opportunity to learn about an issue; but they do not provide the effective motivation to do so. As a result of timing and luck, ozone depletion gave rise to a series of overlapping concerns that played out in a conversational and practical presence.

A cultural whirlwind involves a rapidly evolving and progressive sequence of unexpected and forceful events that create a vortex that hurls through a variety of arenas with a strong conversational and practical presence. A cultural whirlwind may entail an unpredictable and startling personal threat, as in the hot crises surrounding Ebola Zaire, or it may be more benign, as in the whirlwind that built up around recycling in the late 1980s. With Ebola Zaire, fortuitous popular cultural links to movies and books accompanied by timely disease outbreaks and a readily understood "stepping off an aircraft" contagion scenario put the issue in the air (Ungar, 1998b). The recycling bandwagon acquired replicating lives as it extended from schools through country fairs to talk shows, with communities, corporations and individuals vying to establish their green credentials and extend blue box programs (Ungar, 1998c).

The ozone hole asserted itself in the public realm even before scientists concluded that it was due to anthropogenic activities. This second coming of the issue-it first emerged in the 1970s with fears that supersonic aircraft would deplete the ozone layer-induced Americans to rapidly switch away from aerosol cans. This was followed by successful boycotts of McDonalds (and others) for the use of styrofoam. Unsubstantiated reports about animals blinded by the sun tapped into deeper anxieties. Whereas the public paid little attention to scientists' concerns that increased ultraviolet radiation would harm the human immune system, plant and aquatic life (linkages are attenuating, as are the bridging metaphors), a spiraling concern emerged over the threat of skin cancer (Ungar, 1998a).

The principle hazard that came to be associated with leakage through the ozone shield was melanoma, a deadly form of skin cancer. The ensuing progression of events was superb, as President Reagan had skin cancers removed in 1985 and 1987. At the same time, as the end of the Cold War erased the major source of anxiety in American society, the popular culture commercialized a variety of disasters, including new diseases, earthquakes, volcanoes, hurricanes and tornadoes (Colt, 1997). Ozone loss meshed nicely with this disaster boom. Not only is it linked to the theory that a comet striking earth extinguished the dinosaurs, but it transforms routine exposure to sunlight (or being outdoors) into a potentially dangerous activity.

Here it should be underlined how the rapid sequence of events surging through different arenas -boycotts, the Montreal Protocols, President Reagan's skin cancers, medical warnings, and political gaffes-served to unleash a whirlwind around the issue. Thus Interior Secretary Donald Hodel was widely mocked ("fish don't wear sunglasses") when he advocated a "personal protection" plan in the place of international action on the issue (Litfin, 1994: 105-106). But the ozone threat ultimately became intrusive and irresistible because of the imperative of dealing with exposure to the sun. Warnings about (over) exposure became commonplace in stories and advertisements in family and woman's magazines. Metaphors about "safe sun" were boosted by the growth of a companion industry encompassing sunscreens, sunglasses, UV-safe clothing, awnings, and so on. The inclusion of an UV index in weather reports underscored the need for vigilance. So too did reports of increased rates of skin cancer plus medical warnings to watch for skin changes and inspect moles.

The problem became a fertile source of interest, anxiety, and practical knowledge, talk and action as it redounded on the need to protect children (Ungar, 1998a). This is an issue that people can discuss without feeling overwhelmed or stupefied. It also calls for constant vigilance. The sun's rays can often be "felt," and (unexpected) sunburns afford palpable evidence of their (now dangerous) effects. (The earlier cited finding that 24% of parents do not apply sunscreen admits several explanations. First, these respondents had lower levels of education than parents who used sunscreen. Second, the cultural whirlwind over the ozone hole occurred more than a decade ago, and the issue has now been relegated mostly to news briefs).

In contrast, there are apparently no ready-made popular cultural metaphors that provide simple schematics for understanding and concretizing climate change. Even a minimally coherent account of why it is a threat involves loose postulates that span several scientific disciplines and transcend both the public's general understanding of science and the information carrying capacity of most of the mass media (e.g., Hallin, 1992). The upshot is that climate change neither affords an appropriable theory that people can think or talk with, nor does it intrude into their lives in concrete and persistent ways. At the conversational level, climate change seems to engender speech vetoes as complexity and shifting and convoluted predictions-such as hotter and dryer summers accompanied by wetter and colder winters-engender mockery and puzzled questions about what sort of weather is not caused by global warming (Ungar, 1999, 2000). Public understandings are limited to warming, and the colder winters predicted by current models are thought to belie global warming (Kempton et al., 1995: 80-81).

Since climate change is largely a future-oriented problem, it has little immediacy for both talk and action. While extreme weather events serve as the principle public "sign" of climate change, they do not make good candidates for a cultural whirlwind. Ever since the scientific community rebuked James Hansen for claiming that the weather impacts of the summer of 1988 were almost certainly the effects of climate change, the two have been largely disassociated. Despite a host of "strange weather" events and attendant record insurance losses, in a study of the US national network news Ungar (1999) found no correlation between coverage of extreme weather events and stories on climate change. And while many insurance companies have joined the climate change believers, it can be contested that they add little or no credibility to the claims-making process. Ultimately, Stephen Schneider hit the mark when he suggested that climate change exists mostly in the silicon chips of supercomputers. (Parenthetically, an interesting question here is the extent to which the spread of air conditioning and pools has helped to insulate people from heat waves).

CONCLUSION

This paper links the evidence of widespread scientific illiteracy to the specialized KIP. Our ostensible knowledge society is informed by an attention economy that militates against the acquisition of scientific knowledge. The popular culture affords limited screen space and low conversational value to such knowledge. Hence the paper takes scientific ignorance as the norm and suggests that it is pockets of knowledge that require explanation. To break through the veil of ignorance, scientific knowledge must piggyback on a cultural whirlwind and in the process become motivated. The latter requires not just some public understanding of the processes involved, but a sense that they intrude on and are activated in mundane activities. To have an issue that can be talked about, played with, and acted upon is central to unleashing and sustaining a whirlwind.

This analysis does not bode well for the policy process. A cultural whirlwind depends on the availability of bridging metaphors and fortuitous timing, neither of which can be simply manufactured. Climate change illiteracy suggests that people need to learn more if they are to link phenomena like strange weather and their own activities to climate change. But the opportunities and motivations to do so are limited. That the popular culture serves to dumb-down conversation can be inferred from research on people's performance under more ideal conditions. Berk and Schulman (1995) and Kempton et al. (1995) find that respondents in quasi-experimental studies can make complex policy inferences that are surprisingly similar to those made by researchers. People, in other words, possess the capability to grasp the practical dimensions of the problem. But they perform best when they are given a very specific task in an artificial context that is presumably motivating and removes competing diversions. In contrast, Neuman (1990: 13) summarizes research indicating that people approach their ordinary information environment with a "semi-attentive, entertainment-oriented mind-set." Unfortunately, this suggests that the public reception of climate change will depend on extreme weather impacts that can serve as a "beacon" for the problem. Given the strange weather that has already occurred, the signal events are probably more extreme than we might wish or bargain for. ❑

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Same Planet, Different Worlds: The Climate Change Information Gap

Elizabeth L. Chalecki

Scientists and the general public often do not speak the same language when it comes to climate change and other environmental problems. Indeed, a recent public opinion poll by Villanova University shows that most people are concerned about environmental issues such as climate change, but lack a clear understanding of how these problems arise and what to do about them. Data from a bibliography collected by the Pacific Institute shows that while considerable progress has been made in the modeling of climate change effects on first-order systems such as regional hydrology, less effort has gone into modeling, or even speculating on the subsequent effects on second-, third-, and fourth-order economic and social systems (e.g., agriculture, trade balance, and national economic development) that water affects. Not coincidentally, these economic and social systems are the ones that affect most stakeholders directly, and that they are likely to understand.

Current scientific literature only rarely examines the effects of climate change and variability beyond its second-order effects, and is usually only accessible to researchers and educators, two of the six stakeholder groups. As difficult as such studies are to do with a customary degree of scientific exactitude, third- and fourth-order studies relate climate change to where and how people live, to what policies might be most effective and appropriate for addressing severe impacts, and for evaluating economic and policy responses. If impact assessments were more closely related to issues of public interest, the links between individual behavior and global changes in the environment might become more apparent, and public frustration over environmental issues might be transformed into environmentally responsible actions. This paper will briefly review the bibliographic metadata, present a model framework for identifying the different levels of climate change and variability effects on human systems, and discuss the necessity of making scientific information more publicly accessible.

INTRODUCTION

Scientists and the general public often do not speak the same language when it comes to climate change and other environmental problems. Scientists often examine small pieces of larger environmental problems in great detail within the limits of their discipline, while most non-scientists have a somewhat fuzzy understanding of the larger issues, often fed by outdated knowledge and half-formed opinions. Within this information gap lies a disconnect that affects public behavior, environmental conditions, and policy formation across North America.

In 1998, the Pacific Institute, as part of its participation in the U.S. National Assessment of Climate Change, assembled a bibliography of the existing literature on the effects of climate change on U.S. water resources. This bibliographic database (available in searchable form at www.pacinst.org/CCBib.html) contains approximately 950 entries, and is a valuable research and reference tool. However, the entries contained in this database are for the most part highly technical and are designed to be useful only to a limited audience. Most of this literature would be incomprehensible to the average person, yet the daily actions of the average person cause estimates of climate change-induced damage and disruption to increase each year.

As environmental problems such as climate change grow in severity, policy makers look to the public to determine what level of action they should take. The public, in turn, looks to scientists and the media to inform them of the nature of the problem. Since most scientists are conversant in complicated disciplines, they are the ones, in the public eye, who know something about such problems. Why, then, are members of the public not more aware of their individual part in the greenhouse gas emissions that lead to climate change? Why this fundamental information disconnect between scientists and the public, who live on the same planet but inhabit different worlds?

I. PUBLIC OPINION POLLS AND WHAT THEY SHOW

In order to gauge the level of understanding Americans currently have about environmental issues and their causes, and to help set policy objectives at the turn of the century, various opinion polls have been conducted within the past three years.

A. NEETF/Roper

The 1999 NEETF/Roper Environmental Report Card is the country's best known environmental poll. Polling approximately 1500 Americans over age 18, NEETF/Roper asked the respondents what they understood and how they felt about various environmental issues, and graded them as a whole.[1] The 1999 Environmental Readiness Report Card, below, shows that Americans have a poor understanding of environmental issues, answering an average of only three out of ten questions correctly.

Environmental Readiness Report Card	Grade
Attitude	
Support for the environment	A+
Willingness to work toward balanced solutions	A
Knowledge	
Understanding of causes of basic environmental problems in the 21st century	F
Agreement with experts on the top issues in the 21st century	D
Action	
Willingness to take steps to solve problems	B

(source: NEETF/Roper 1999)

Specifically with regard to climate change, 77% of respondents considered it a very serious or somewhat serious environmental issue within the next 15 to 25 years. However, only 45% were able to identify increased carbon emissions as the main cause of climate change; slightly more than one-quarter (26%) of respondents attributed climate change to increased sunlight falling through the hole in the ozone layer, perhaps indicating that people associate global issues together without careful distinction.

Interestingly, 40% of those who believe that environmental regulation has gone too far still feel that environmental catastrophe looms within the next decade.

The NEETF/Roper poll recognizes the link between public knowledge, behavior, and policy with regards to environmental issues.

> "A sound basis of environmental knowledge materially changes the way individuals view environmental issues. Knowledge is empowering in several ways. The more knowledge people possess about the environment, the less likely they are to be alarmed about potential for environmental disasters in the future, and the more likely they are to see an issue as being under their control. Consequently, they are more likely to take action or support actions that will actually benefit the environment. More knowledge also helps direct people's support toward larger strategies and policies that are needed to tackle environmental problems.

> Ultimately, understanding what Americans know about the environment will help us tailor educational programs to specific topics and misconceptions, which in turn will help individuals and their leaders to better understand why laws are passed to protect the environment and how their actions affect the environment" (NEETF/Roper 1999, p. 8).

B. Immerwahr/Public Agenda

In 1997-98, John Immerwahr of Villanova University and the non-profit group Public Agenda conducted surveys and focus groups in five different cities (Washington, Charleston, Los Angeles, Des Moines, and Phoenix) which uncovered the public's discouragement at how unsolvable climate change and other environmental problems seem.[2] This stems from two perceptions: first, that these problems are so complicated that even scientists can't agree on what to do, and second, that climate change, pollution and other such environmental concerns are a result of human greed and selfishness, and since these personality characteristics appear to be unchangeable, the respondents doubted that these problems could be solved at all.

Similar to the NEETF/Roper poll, the Public Agenda poll revealed that 74% of respondents feel that the earth's atmosphere is warming as a result of air pollution and that, in the long run, this could have catastrophic results. However, from 1989 to 1997, the percentage of people who worried a great deal about climate change dropped from 35% to 24%. The public also believes that even scientists are divided on this issue. Despite over 1,500 of the world's leading scientists from 63 countries predicting that climate change is occurring and recommending action (UCS 1997), and only one or two outspoken individuals actively denying the possibility of global warming, a 1997 Gallup/CNN/USA Today survey revealed that only 42% of respondents believed that scientists mostly agreed that global warming was a serious threat; a slightly higher number (44%) believed that there was no scientific consensus on the matter (Gallup 1997).

More alarming was Immerwahr's finding that the public's concern about climate change was translating into frustration and resignation rather than action. The poll respondents generally felt that individuals modifying their behavior was impossible, and that the solutions to global warming, if any, would come either in the form of painless technological changes or an environmental catastrophe that would force radical behavior changes across the whole society. His poll concluded that,

> The public has clearly not reached a position of consensus on the issue of global warming. Although there is consensus that there is a problem, there is no sense that scientists have clearly spoken about the nature of the problem. Nor is there a widely perceived sense about what the country might do about it, or whether those steps would be efficacious. As a result people are upset about the problem, but their concern translates into frustration rather than support for action. (Immerwahr 1999, p. 15).

Peter Berle, host of NPR's "Environment Show," agrees. The shows he devotes to climate change do not generate a high response level from listeners, and those that do contact the show are not very knowledgeable about climate change itself. "People generally know that the 1990s have been the hottest decade in history, but they do not make the connection between their behavior and the environmental consequences." (Berle 2000)

II. CLIMATE CHANGE EFFECTS FRAMEWORK AND BIBLIOGRAPHIC METADATA

To be fair to the public, climate change is not an easy phenomenon to understand. It is a complex physical process, with implications for every aspect of the earth's atmospheric, hydrologic, and oceanic systems. Increasing greenhouse gas concentrations will have direct, or first-order, effects on air temperature, atmospheric dynamics, precipitation, runoff, and sea level. These geophysical processes in turn affect other physical, biological, and ecological processes such as forest growth, agricultural productivity, fisheries, flood frequencies, and smog formation. For example, decreases in precipitation in forests could lead to slower tree growth, higher temperature could alter soil moisture conditions and irrigation requirements. These are considered second-order effects, because they are not affected directly, but rather through the first-order processes. Changes in the second-order processes, in turn, affect economic and human health systems, or third-order processes, such as illness rates, food and electricity prices, and national trade balance fluctuations (e.g., slower tree growth means less timber harvested and higher lumber prices). Finally, changes in third-order processes affect fourth-order, or social systems, such as national security status or migration rates (e.g., influx of foreign lumber means cheaper housing prices, but outflow of workers from lumber industry).

Figure 1 illustrates a framework for thinking about the connections among these different levels of impacts. This figure by no means outlines every single system that climate change affects, but it is designed to illustrate the interconnectedness of climate change effects. Furthermore, climate is not the only driver of change in this framework: as the order of effects rises, more and more non-climate variables intervene. For example, lumber prices are affected by forest productivity (in turn affected by precipitation, among other factors), but they are also affected by political and social trends as well as transportation costs. Determining how much of a change in lumber prices comes directly from a change in climate is difficult to measure, because one can never account for all the intervening variables. However, such third- and fourth-order systems impact the lives of the public most directly: telling someone that climate change may cause a decrease in streamflow will not have the same reso-

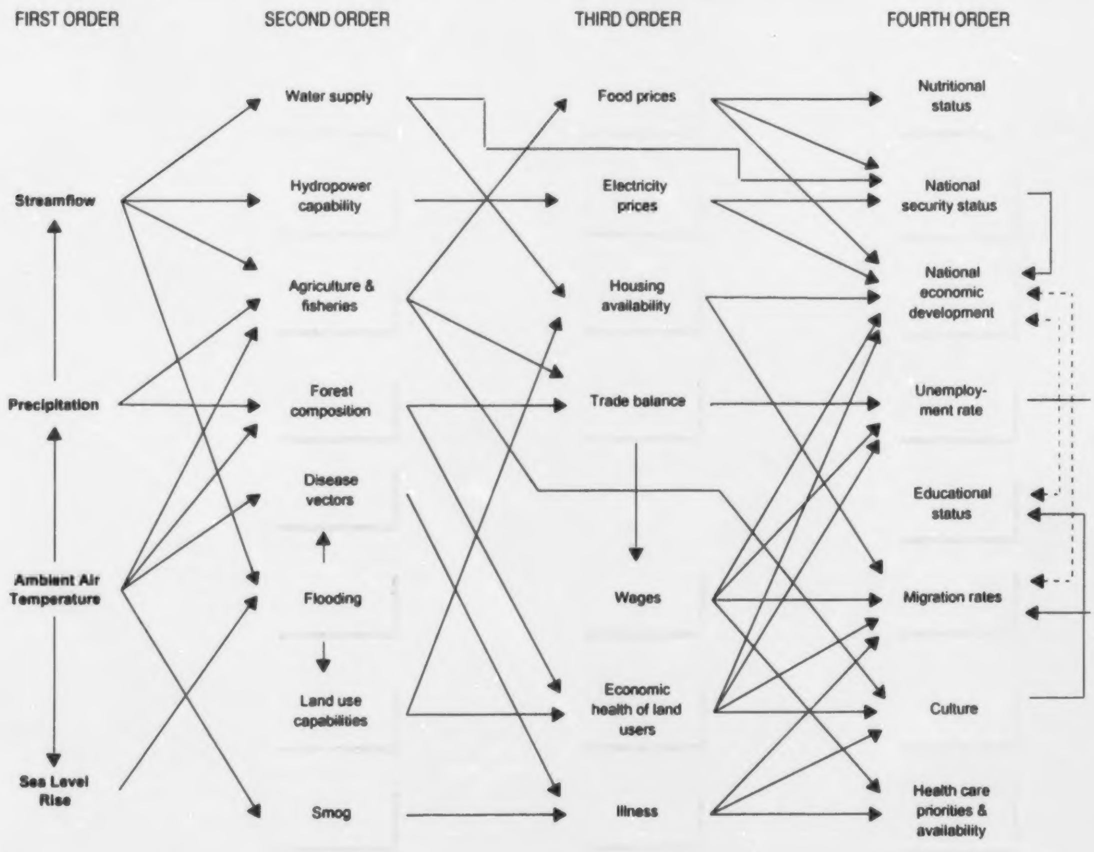

FIRST ORDER
SECOND ORDER
THIRD ORDER
FOURTH ORDER
Streamflow
Precipitation
Ambient Air Temperature
Sea Level Rise
Water supply
Hydropower capability
Agriculture & fisheries
Forest composition
Disease vectors
Flooding
Land use capabilities
Smog
Food prices
Electricity prices
Housing availability
Trade balance
Wages
Economic health of land users
Illness
Nutritional status
National security status
National economic development
Unemploy-ment rate
Educational status
Migration rates
Culture
Health care priorities & availability

Figure 1: Climate Change Effects Framework
(source: Chalecki & Gleick 1999)

The solid arrows indicate direct effects from one order to another, while the dashed arrows indicate a recursive set of effects.

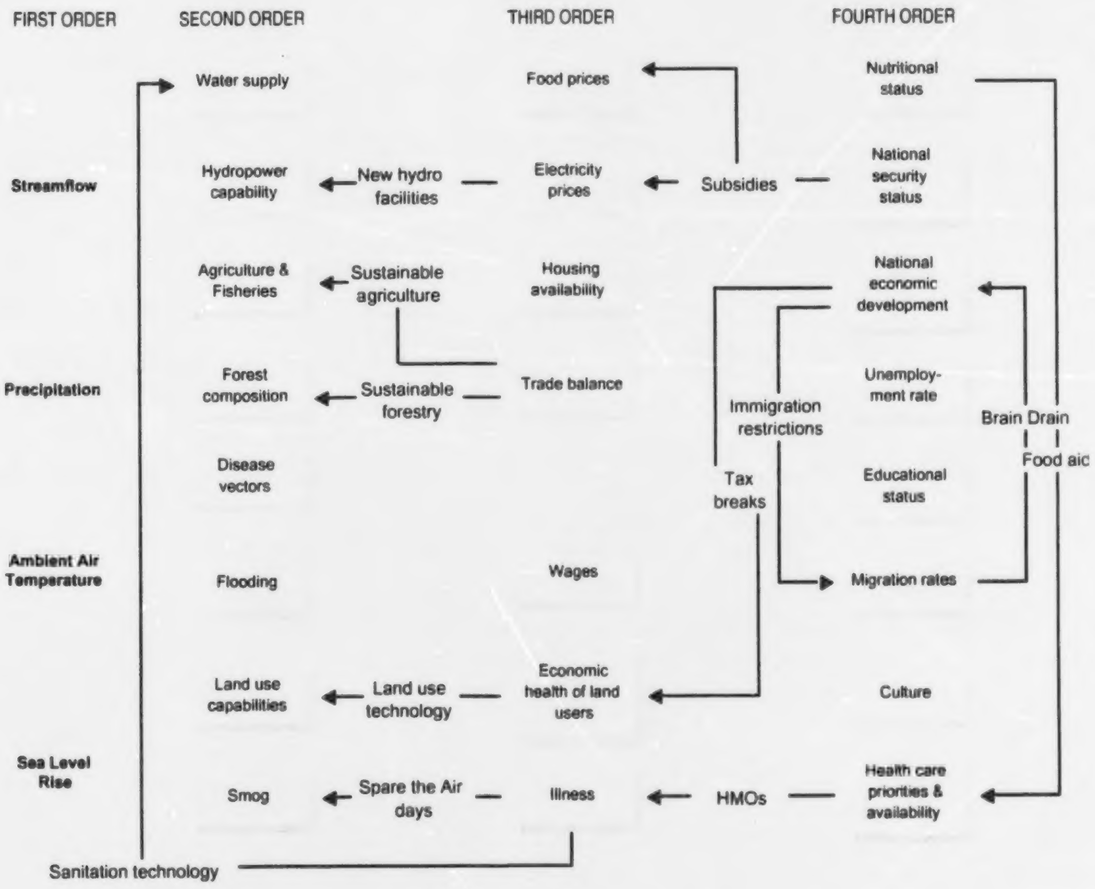

FIRST ORDER
SECOND ORDER
THIRD ORDER
FOURTH ORDER
Water supply
Food prices
Nutritional status
Streamflow
Hydropower capability
New hydro facilities
Electricity prices
Subsidies
National security status
Agriculture & Fisheries
Sustainable agriculture
Housing availability
National economic development
Precipitation
Forest composition
Sustainable forestry
Trade balance
Immigration restrictions
Unemployment rate
Brain Drain
Disease vectors
Tax breaks
Educational status
Food aid
Ambient Air Temperature
Flooding
Wages
Migration rates
Land use capabilities
Land use technology
Economic health of land users
Culture
Sea Level Rise
Smog
Spare the Air days
Illness
HMOs
Health care priorities & availability
Sanitation technology

Figure 2: Climate Change Feedback Loops
(source: Chalecki & Gleick 1999)

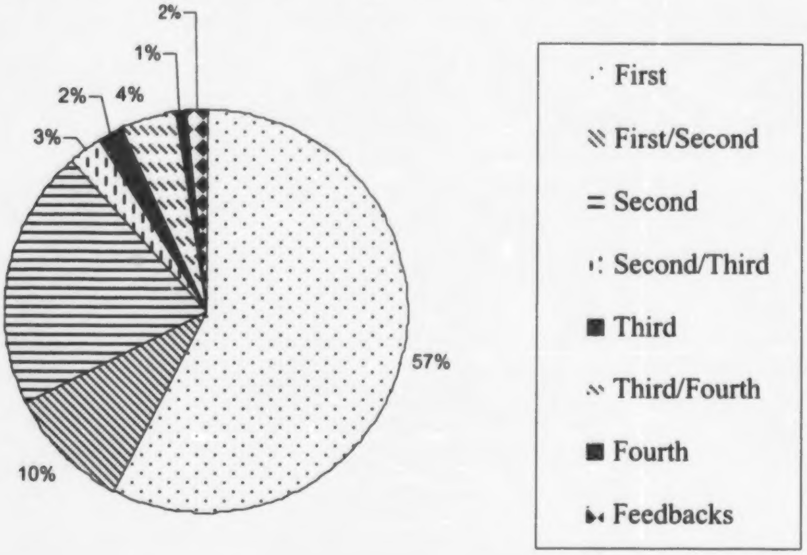
nance as telling someone that the same climate change may cause their electricity bill to go up. If scientists had unlimited time to study the climate change phenomenon, perhaps the lower order effects could be mapped completely prior to consideration of the higher order effects. But as greenhouse gases continue to accumulate, these climate change effects will begin to occur before we have completely understood them.

Further complicating the framework are the many feedback loops (Figure 2) that have been put into place by human society to address variability in climatic conditions.

First-order climate effects are geophysical in nature and are represented by models such as General Circulation Models (GCMs). Second-order effects can be physical, ecological, or biological, and are usually represented by linked models (e.g., a precipitation/temperature model coupled with an agricultural output model). Third-order effects are rooted in economic or human health systems, and are rarely modeled or quantified successfully, though reasonable qualitative statements can be made about them. Fourth-order effects are social in nature, and examining the effect of climate change on fourth-order systems is, at this point, merely speculative.

Such a formalized framework of climate change effects only serves to reinforce what common sense tells us, that

Figure 3: Distribution of Keyword Appearances by Effect Order



complex processes are made up of the interactions between simple processes. Yet to the public, a hydrologic model appears complex, but the relationship between smog from traffic and worsening asthma rates is simple. For this reason, most people tend to oversimplify complex problems (e.g., climate change is caused by pollution, human activities will destroy the environment (Immerwahr 1999)).

Despite all the scientific work done on the effects of climate change, the results of this research are not making their way into the public consciousness, as evidenced by the NEETF/Roper, Public Agenda, and other polls. The existence of such an information gap means that science has the opportunity to step in and inform public opinion, yet to date has failed to do so.

Examination of the bibliographic metadata (Figure 3) shows that 67% of the entries dealt with the effects of climate change on first and first-second order effects. 21% dealt with second order effects, and only 12% dealt with second-third and higher orders. Very few papers dealt with the effects of climate change on complex human economic and social systems. This may occur because most scientists who write and publish these papers are more comfortable with quantifiable theories and computer models. When a model run spits out a strangely anomalous result, it is easy to reexamine the model parameters to determine what went wrong, so certainty of model results is relatively high. When discussing human systems, however, many more variables intervene and it is difficult to distinguish the signal of climate change effects from the noise of other effects. Consequently, it is much more difficult to know what sort of predictions are reasonable, or how future conditions may fluctuate. Yet this dearth of higher-order research is partly responsible for the information gap between environmental scientists and the general public.

III. DISCUSSION

Unfortunately for the cause of public understanding, the types of journals that publish papers like "Dynamic Land Surface/Atmospheric Parameterization for the South Platte River Drainage" (Baron et al, 1993), "Estimated Annual Regime of Energy-Balance Components, Evapotranspiration and Soil Moisture for a Drainage Basin in the Case of a CO2 Doubling" (Bultot et al, 1988), "Simulation of Precipitation in the Gunnison River Basin Using an Orographic-Precipitation Model" (Hay et al, 1993), or "The Application of a Coupled Water Balance Salinity Model to Evaluation of the Sensitivity of a Lake Dominated By Groundwater to Climatic

Variability" (Crowe 1993) do not appeal to the general public. While these papers are sound scientific studies of valid climatic issues, their audience is limited to co-specialists in the same field. In addition, the technical vocabulary specific to each discipline would generally make such papers largely incomprehensible to the lay person.

Art Hobson, professor *emeritus* at the University of Arkansas, opines that scientists write scientifically abstruse papers because it is in their interest to do so; the current academic system rewards research, not public outreach (Hobson 2000). Hobson's long interest in science education leads him to believe that since scientific advancement is not dependent upon teaching or public understanding of science, then the whole academic system must be changed in order to persuade scientists to engage in public outreach via the media. Phillip Campbell, editor of Nature, agrees and recommends that professional and scientific societies serve as points of contact for members of the media, and provide clear descriptions of scientific issues as media background material. This may occur in the United States; however, he sees little hope for such a change in Europe, where he points out that developing a relationship with the media is considered an unnecessary waste of time for a serious scientist (Campbell 2000).

CONCLUSION

If environmental scientists can be convinced that greater public understanding of their work on climate change will lead to changes in public behavior, then perhaps there are several options to increase scientific communication.

Campbell recommends more outreach on the part of scientific and learned organizations, and in fact the American Association for the Advancement of Science, the nation's largest science professional organization, has a Public Understanding of Science and Technology program). This program includes science/technology programming for print, radio, television, electronic media; fostering nontraditional mechanisms that communicate science to the public; and programs that help scientists and engineers communicate with the public (AAAS 2000). Berle points out that the volume of science outreach will increase if scientific issues are inserted into unusual venues, such as pop culture media. Hobson's recommendations are more specific: in order to appeal to the intelligent layperson, basic science outreach should contain no algebra or calculus, should use simple graphics, and should keep the use of technical terms to an absolute minimum. George Nelson, director of AAAS's Project 2061 on science education in schools, thinks that clear explanations of climate change and other environmental issues is good but doesn't go far enough. In order to have a lasting effect on public behavior, science outreach must change the way people think by educating them to apply scientific thought to real world environmental phenomena (Nelson 2000).

NEETF recommendations include developing and publishing a People-to-Problem Index for public education. Such an index would measure the degree to which an environmental problem has a public involvement component. A problem like climate change with a high PPI requires a large amount of public awareness to contribute to a real solution. A problem with a low PPI, like toxic waste, can be solved with a lower amount of public participation. Such an index might serve as a signal to environmental groups and educators as to which environmental problems need increased public exposure. NEETF also calls for greater education of media, as well as research into how the public learns about environmental issues and what motivates them to work toward their solutions (NEETF/Roper 1999, p.5). Recommendations such as these that make current scientific research more accessible to the public will go a long way toward closing the information gap between scientists and the general public. ❑

ACKNOWLEDGEMENTS

Thanks to Michael Cohen for useful comments, and to Amar Mann for interesting discussion on the public responsibility of scientists.

ENDNOTES

1. All data in this section comes from the 1999 NEETF/Roper poll, found on-line at www.neetf.org/reportcard/index.htm.
2. Unless otherwise noted, all data in this section comes from the 1999 Public Agenda poll, found on-line at www.agu.org/sci_soc/sci_soc.html.

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Brownlash Communication about Climate Change: An Analysis of Recent Publications by the Fraser Institute

Hilda McKenzie

ABSTRACT

Communication about climate change is of crucial importance in the worldwide movement to adequately understand climate change, to inform people about it, and to enlist support for policy initiatives to combat it. However, despite the growing scientific and public consensus on the necessity of taking action against climate change, the representation of the issue is still being contested: the existence of climate change and the fact that human activities contribute significantly to it are still frequently presented, in mainstream media sources, as questionable. A particularly prolific and often cited source of writings claiming that no action should be taken against climate change is the Fraser Institute, a Vancouver-based right-wing think tank. Recent Fraser Institute publications that discuss climate change include the book Global Warming: the Science and the Politics (1997) and a series of annual reports titled Environmental Indicators for Canada and the United States (1997, 1998, 1999). These publications attempt to put in question both the existence of climate change and whether carbon dioxide emissions contribute to it. The Environmental Indicators reports claim that no action should be taken against climate change, because "a great deal of uncertainty surrounds the issue" (48): "Some argue that we must take drastic regulatory action to control greenhouse gases without delay. However, because of the uncertainty and the unanswered questions, this is a simplistic approach to policy. In fact, we cannot afford to take action until we are reasonably certain that we have a problem" (48). Such publications are instances of what Paul Ehrlich and Anne Ehrlich (in Betrayal of Science and Reason: How Anti-Environmental Rhetoric Threatens our Future, Washington, DC: Island Press, 1996) term brownlash writing; they work, as Ehrlich and Ehrlich say of brownlash texts in general, to "minimize the seriousness of environmental problems" and to "help to fuel a backlash against 'green' policies" (1). In this presentation, I will analyze the position the Fraser Institute takes on climate change, the underlying assumptions of its position, and the rhetorical means by which it supports its position. In conclusion, I will discuss the importance of combatting brownlash writings on climate change in general and those of the Fraser Institute in particular. ❑

Session A3

CIVIC ENGAGEMENT 1: ORGANIZATIONAL ROLES

The Role of NGOs in Promoting Climate Change: An EU Perspective
Daphne Biliouri
Independent Consultant

A Municipal Role in Climate Change
Azzah Jeena
Federation of Canadian Municipalities

Public Education and Outreach to Reach Canadians: The Federal Perspective
Neil McCleod
Natural Resources Canada

A Scientist's Role in Communicating Climate Change
David Henderson[1] *and Fred Herfst*[2]
1. Canadian Climate Change Board
2. Canadian Institute for Climate Studies

The Role of NGOs in Promoting Climate Change: An EU Perspective

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Daphne Biliouri

Environmental NGOs world-wide have taken a diverse approach in promoting various environmental issues influenced by the political, social and economic structure of each region. The European Union (EU) is of particular interest as it has been the lobbying ground of many international environmental NGOs and it has set itself a strong environmental policy addressing issues such as climate change and the integration of the environment within other policies.

The majority of large environmental NGOs, such as WWF, Friends of the Earth and Greenpeace, have established European Units in order to influence directly the member states of the EU and the environmental activities of the EU as a whole. However, it is the creation of specific teams within these European Units that address major environmental issues - such as climate change - that indicate the importance of these issues. The teams on climate change comprise of scientific experts, researchers and policy analysts that aim towards the definition of climate change and the need to clarify any misconceptions that surround the climate change issue. They exist in order to provide extensive evidence on the effects of climate change on the planet and minimise the scientific uncertainty that surrounds the issue.

Environmental NGOs within the EU realm have tried to introduce the topic of climate change to the public and the decision-making bodies in order to gain their support. Their more successful methods have been the distribution of regular press releases to the media and the publication of articles by academics that have been contracted by the NGOs to provide well-supported and objective evidence. NGOs have extensively lobbied the governing authorities of the EU hoping to influence the positions of the decision-makers on issues directly linked to climate change.

Nevertheless, the efforts of the NGOs so far have proved modest and often insufficient. There is lack of co-operation and co-ordination amongst the environmental NGOs themselves and lack of communication between the NGO sector and the media, academia and governing authorities. On this basis a new framework of action needs to be established and implemented to ensure a unified approach towards the promotion of climate change.

INTRODUCTION

Over the past two decades, climate change has become an issue that has attracted the attention of governments, the media, the public and the scientific community. A topic of endless controversy and scientific uncertainty, it has proved a challenge for environmentalists and environmental NGOs to ensure that it is addressed promptly and sufficiently.

Climate change is considered a global issue of transboundary nature that is affecting each state beyond its national borders. Therefore, as the IPCC report of 1990 emphasised, climate change requires global responses and action that will have considerable economic and social impacts. The IPCC also indicated that both developed and developing countries have a shared responsibility to deal with the issue. However, political tensions and agreements to reduce greenhouse gas emissions are constantly hampered by tensions between states over how responsibility should be allocated. Over the years information has been accumulated on the causes of the problem, the consequences and the international strategies to try to limit Climate Change. However, scientific uncertainty over how much climate change will affect the ecosystem and whether it will have devastating impact on human society has restricted any concrete action to address the issue and minimise the effects of climate change on society (Whyte, 1995).

The Kyoto Protocol that derived from the 3rd Conference of Parties (COP3) of the UN Framework Convention on Climate Change (UNFCCC) was set as add-on to the UNFCCC in an effort to provide a more effective set of measures to battle climate change than the ones set during the Rio Summit in 1992. The Kyoto Protocol set up three mechanisms to reduce the effects of climate change: a clean development mechanism, an emissions trading system and joint implementation. Unfortunately, no agreement on penalties for countries that do not comply with the measures set led to yet another weak action.[1] The main disagreement between US and the European Union (EU) over emissions trading will be viewed in the following section.

After an unsuccessful meeting in Buenos Aires for the CO4 to the UNFCCC in 1998, the CO5 to the UNFCCC was held in Bonn in November 1999. The COP5 of the UNFCCC in Bonn in November 1999 hoped to inspire enough countries to ratify the Kyoto Protocol so that it can enter into force. During the COP5, the 15-nation EU announced that it is "willing and ready to ratify the Kyoto Protocol on climate change by the Rio+10 conference" in 2002. But this gesture of a strong support for more stringent measures on climate change is conditional and may be amended depending on the position of other parties to the ratification deadline, particularly regarding the United States. The Kyoto protocol will become legally binding when at least 55 countries ratify it. To date only 16 countries have ratified the Protocol with the EU and 36 countries signing the agreement and it is hoped that the CO6 this coming November will set the wheels turning and the Protocol will be brought into force by 2002 with no further delays.

THE EU POSITION

Climate change has been on the top of the EU's political agenda and is one of the main issues that prevailed in the 5th Environmental Action Programme (EAP). In Rio the EU undertook to stabilise CO2 emissions at 1990 levels by the year 2000, although individual targets for each Member State were not set.[2] Under the Kyoto Protocol the EU set a legally binding 8% reduction target between 2008 and 2012 for 6 greenhouse gases.[3]

The EU is responsible for about 12% of the world's total annual CO2 emissions but unlike the US, it took a very progressive stand during the climate negotiations and was prepared to endorse a convention with specific targets and timetables. However, each state still has to set specific measures to comply with. Nevertheless, the EU's decision to stabilise CO2 emission at a Union level creates more flexibility among the member states. The more industrialised nations would make greater efforts to cut emissions creating the margin necessary for the less developed EU states such as the Mediterranean countries. Such a flexible approach called 'burden sharing' is necessary to ensure the participation of all parties. It needs to be noted that member states have made different commitments with respect to stabilising emissions in order to comply with their economic growth and the idea of sustainable development, as it was developed in the 5th EAP.

The EU strategy is based on a combination of the principle of no-regrets and the search of minimal cost solutions. Therefore, it was recommended by the Commission to use a variety of instruments (voluntary agreements, research, energy and carbon tax) but unfortunately as the actual implementation has been left to individual states, the reduction of climate change has been restricted along with constraints placed upon the EU system through international negotiations. Often the environmental policy of the EU has clashed with the development and implementation of other sector policy developments. The friction between environmental and economic interests and between individual state and EU interests can be seen in the attempt to introduce a carbon tax in 1992. But countries like the UK opposed the proposal because it saw overcompensating for other states' inefficient measures. As a result, this proposal was opposed within the Council and was dropped by 1994 at the EU government meeting in Germany. Subsequently, no legislation was agreed even though most member states were in favour and some of them (Denmark, Finland, Sweden and the Netherlands) have introduced a tax. Taking a different approach, in March 1997 the Commission based on Taxation Commissioner Mario Monti's suggestions, proposed a common system for the taxation of energy products, mainly natural gas and electricity, while renewable resources, biofuels, energy from pilot projects and energy used for rail and inland waterways would be exempt from taxation. Progress has not been achieved even though the proposal has been amended for an energy products tax because a unanimous vote is required for a tax-policy proposal to be adopted. Member states are divided over these proposals, therefore making it almost impossible to negotiate at a national level and comply with an EU directive.

The 'greening' of the energy sector is an essential part for the desired 8% cut on greenhouse gas emissions by the year 2012 and along with energy tax the next step is initiatives to boost renewable energy. At that level, several measures have been developed to increase the development of non-polluting energy sources- wind, water, solar power and biomass- to improve the use of energy in the industrial and housing sector and promote the improvement of transport infrastructure. All these measures have been implemented through the JOULE, THERMIE, SAVE and ALTENER programmes. However, these programmes have received less funding that original proposed and had little impact on providing a solution to climate change. ALTENER, the only Community programme to focus exclusively on the promotion of renewable energy sources, ended its five-year term at the end of 1997. It has now been succeeded by ALTENER II, an initiative that will extend activities in the renewable energies field and make a major contribution to the Community Strategy and the EAP. The JOULE-THERMIE (1995-98) is a non-nuclear research programme encouraging environmentally safe energy options.

In addition to these voluntary measures, the recent voluntary agreement reached with the European car industry hopes to provide a contribution to curbing CO2 emissions from individual cars in the next decade. The trends in sectors such as industry indicated a growing uptake of energy efficient technologies with a predicted 15% fall in industrial CO2 emissions by 2010. The projections for transport, though, show continuing growth in emissions which will not comply with the Kyoto targets.

For the future, the member states have still to set concrete plans for their individual targets within the framework of the Community strategy for meeting the Kyoto commitment. Despite continuous criticism from the Commission and the European NGOs, the members states have proved unwilling to introduce what they see as unpopular policies that will decrease the amount of greenhouse gas emissions.

As the Environment Commissioner Margot Wallstrom indicated in November 1999 with the publication of a report assessing the 5th EAP, the EU has singularly failed to address the problem of global warming. "The main problem is that we have not achieved much progress in changing economic and social trends" she said. The main problem holding up the process is the failure of the EU governments to agree on a plan to harmonise taxes on coal, electricity, gas and mineral oils. She also recently pointed out that priority should be given to force member states to comply with the environmental laws that are in force instead of drawing up additional legislation. Within this framework, the European Council invited the Commission to prepare a proposal for the sixth environmental action programme by the end of 2000 and to submit a sustainable development strategy to it in June 2001.

The European Commission wants to give new impetus to the Community's efforts for reducing greenhouse gases that lead to global warming. Launching the European Climate Change Programme with two initiatives adopted in 8 March 2000, the Commission advocates a twin-track strategy for implementing the emission reduction target. A Green Paper on emissions trading foresees the setting-up of an emissions trading system within the EU for the energy sector and big industrial installations and second, the implementation of measures to reduce emissions from specific sources. The two documents are an important stepping stone in the preparations for the EU's ratification of the Kyoto Protocol after the COP6 to the UNFCCC due to take place in November 2000 in The Hague.

In reference to the Eastern and Central European countries (CEE) that are seeking membership within the EU, most of them have tried to adopt similar targets as the EU. Until the 1980s, the CEE states were responsible for almost twice the amount of CO2 emissions than Western Europe because of inefficient utilisation of energy and the continuous improvements in technology that was taking place in Western Europe. Over the past decade though, CO2 emissions in CEE countries have been lower than in Western Europe because of economic restructuring but as soon as the transition is completed it is anticipated that emission trends will increase again if the proper technology is not provided to them and they do not introduce energy efficiency and renewable energy sources. That is why the EU is trying to raise environmental protection standards in industry closer to the Western Europe levels and provide a decent industrial and social infrastructure for the future to avoid any further environmental decline. But as it has been mentioned such changes presuppose economic and political transformation.

We must not also forget that even if the EU manages to achieve part of its targets there is still the rest of the world that needs to reduce the greenhouse gas emissions, particularly the US as one of the main CO2 producers. During the COP6, all the countries will meet to try and find a way to fulfil the promises that were set in Kyoto in 1997 and one of the biggest issues that will be fought between the EU and the US will be the policy of 'emissions trading'.[4] This policy has been criticised extensively as 'buying the right to pollute'. While the EU insists that emissions trading should only be used to supplement national emission rules, the US argues that no limits should be placed on its use deterring the purpose of emissions control. The constant push of the EU for setting a ceiling on tradable permits has been received with great scepticism from the US government.

However, the meeting of the G8 countries in April 2000 indicated the gradual development on the issue of climate change as they agreed that an early ratification of the Kyoto Protocol was necessary and that most countries should achieve that by the year 2002. It was perceived by environmental groups as clearly a step forward. "I think it was a success that the countries of the EU were able to persuade the United States to agree on the clause for the 2002 date," said Yurika Ayukawa, Climate Change Campaign Officer for World Wildlife Fund Japan.

Before the role of environmental NGOs within the EU process is viewed, it is essential to mention also the role of the major information tool of the EU regarding environmental issues - the European Environmental Agency.

European Environmental Agency (EEA)

The EEA was launched in 1993 with a mandate to collect and provide information for the protection and improvement of Europe's environment. Based in Copenhagen it enables the EU member states to take the necessary measures and it monitors and assesses their work while it ensures that the public is aware of all environmental issues affecting the European environment. Regarding climate change, the EEA in its report on the current state of the environment predicts that by 2010 Europe's output of greenhouse gases will be 55% above the 1990 level (EEA report, 2000). Despite the measures that the EU has taken, these initiatives are not sufficient and the great challenge will be addressing the reduction of greenhouse gas emissions. It also questions the establishment of energy/carbon taxes and energy efficiency programmes as the best solutions. According to the EEA base-line scenario, a 45% increase in economic growth in Europe is expected by 2010. This will have great environmental impacts and will jeopardise the concept of sustainable development while the increase in the use of energy will release more CO2 emissions.[5]

As EEA director, Jimenez Beltran said: "We can no longer avoid climate change.... It is quite clear that the greenhouse effect cannot be prevented. It is worrying that the Kyoto target was insufficient, but gives even more cause of concern is that this humble target will not be met." He also pointed out that the different approach taken between the EU and the US regarding the precautionary principle will not allow for an immediate response to the climate change issue. Regarding the increasing role of NGOs he commented that because of their work, civil society and the political system are becoming increasingly sensitive and have started to react to the negative environmental impacts.

THE NGO PERSPECTIVE

The NGO community played a key role in lobbying governments prior and during the COP meetings and particularly during the COP5 in Bonn to adopt the 2002 deadline. The NGO community was disappointed by the low target agreed by the EU in Kyoto and the fact that it was set-for 2005. Despite arguing for immediate action, there has been a delay on any international response while continuous disagreements over who is responsible for the occurrence of climate change have underpinned any concrete action from all relevant parties. As Friends of the Earth indicated, the principle of equity is deeply enshrined within the UN Climate Convention and any future commitments should be based on the concept of convergence in per capita for all countries by 2050.[6]

Greeenpeace also estimated that to limit climate change to a level that does not cause extensive damage to the ecosystem, only one quarter of the present fossil fuel reserves can be used within the 21st century.

NGOs also are opposed to the 'basket' approach as it makes it almost impossible to assess and monitor the progress made in the control of fuel emissions. Therefore, they recommend a gas-to-gas approach where each gas can be assessed and better guidance can be provided to policy makers to promote a more comprehensive approach on gas emissions. Prior to the COP5 there were a multitude of loopholes which NGOs wanted to see closed, in order for the protocol to become effective. The problems include:

- rules for tradable emission quotas need to be established. This will allow parties to buy unused quotas from states like Russian and Ukraine (30% below 1990 levels due to their industrial decline) in order to avoid making all the cuts in their own country. No limit has been set concerning the contribution which emissions trading can make towards a country's reduction promises.
- NGOs demand the development of nuclear power and large scale hydro-electric power to be excluded from possible policies on the ground of their environmental impacts.
- Forests and other vegetation will be accounted for as emission 'sinks'. But there is concern over how sinks will be implemented and determine with the assistance of the scientific community the net absorption of CO2.

NGOs are calling for greater policy integration to ensure that policies support the aim of reduction of CO2 and other emissions. Coordination of agricultural policy, regional development policy, structural funds, external relations as well as environment, transport and energy policies is needed and ensure incentives for technologies that will increase emissions need to be removed. Therefore renewable energy and energy efficiency should be a great part of EU policy. So far progress with such initiatives has been unsatisfactory with incoherent policies being established and inadequate spending on promoting sustainable energy options. EU programmes such as SAVE, ALTENER aiming at supporting renewable energy receive but a fraction of the 100 billion ECU going to agriculture and the structural and cohesion funds.[7]

However, it must be understood that despite the eagerness of NGOs to protect the environment and find an answer to climate change, they have been characterised as having limited access and little influence on the negotiation process. Although this may have been the case at the beginning of the appearance of climate change as an international environmental issue, their role has changed this past decade. The whole concept of an NGO as a group of passionate environmentalists has changed to a well-structured and well-researched group of professionals seeking to find solutions that will promote environmental awareness, seek a solution to the issue of climate change and influence at the best of their abilities the public, the media and most importantly the decision-makers at a national, regional and international level. There is still a lack of understanding of the positive role that NGOs can play in the decision-making process. However, in some countries initial public support can turn to criticism if the governments refuse to take into consideration NGO opinions and suggestions or formulate programmes without previous consultation with the NGOs, as they are becoming more capable in proposing alternative solutions.

From the beginning, the Directorate-General for the Environment (DG XI) welcomed NGO participation and provided financial support. Consultation with NGOs is common at the EU level and at national level through official advisory structures that allow the revision of government policies, develop proposals related to the environment. To ensure the coordination of environmental NGOs, the European Environmental Bureau (EEB) was created. The EEB was established in 1974, after the publication of the first EAP, as an umbrella organisation to bring together European environmental NGOs in order to structure a more powerful lobbying position to promote climate change as an environmental issue within the decision-making of the EU. Nowadays, EEB covers 130 organisations in 24 countries. The limitations that are set regarding membership is the exclusion of small, politically assertive and unconventional environmental groups and groups that are explicitly linked to a political party. According to the EEB, the Commission should strengthen the role of NGOs and public authorities in technical consultations that form the basis of EU environmental policy. In a report published in April 2000, the group says industry interests are dominating many of the EU committees that discuss policy initiatives. "The European Commission so far has failed to develop a systematic policy strategy to balance stakeholder participation. This should be a major issue for the sixth environmental action programme," said EEB Secretary General John Hontelez.

What follows is a close examination of some of the most prominent environmental NGOs and how they have succeeded to promote climate change within the EU.

Friends of the Earth (FoE)

FoE started as an environmental group campaigning for energy efficiency and against nuclear power. This area of interest continues to be the central point of FoE's existence and the issue of climate change has only strengthen the reason for their presence and activities. The creation of the Intergovernmental Panel on Climate Change(IPCC), a group of scientists and policy analysts formed under the auspice of the UN, gave a reason for FoE to start a global campaign on climate change. Initially this campaign was established in order to fight against the nuclear power industry and the best way they discovered was to fight them on the economic ground. As Pad Green, radiation campaigner for FoE recalls: "You can't separate the environment from economic considerations and environmental pressure groups made sure that market costs reflect the real risks"(Lamb, 1996).

FoE was one of the first NGOs to publish a report in 1988 on the scientific awareness of climate change and after that publication FoE was perceived as 'a leading opinion-former on the issue that most people deeply feared but few really understood'. FoE tends to see in an optimistic view the whole process as with the growing pressures to combat climate change, a solution will be achieved. But this solution will involve major social and economic reforms and that is a challenge that western societies never had to face before.

What differentiates FoE from the other NGOs is the division of labour as each country office takes up specific projects and often. Therefore, it is difficult to compare the work of the diverse FOE offices as they work independently with a very loose central connection. FoE Europe has the unique role of influencing the EU institutions and brings together the work of other country offices on issues that are addressed or hoped to be addressed by the EU political agenda. Regarding climate change, it has created a web of information and has supported the Green Energy campaign which covers aspects of climate change in conjunction with the energy sector. The homepage of this campaign contains extensive papers and scientific reports on climate change. They have also presented a lengthy report on the impacts and solutions of the three mechanisms that the Kyoto Protocol established. Through this site, the individual has several options to show his/her support for the climate change. These are:

- joining Climate Online- an email network promoting solutions for climate change,
- supporting the Green Energy Pack- a list of activities that each individual can do in order to minimise greenhouse gas emissions and promote alternative energy in the household and at work and
- pressuring the government by the classic method of contacting government officials that will introduce stronger government action.

Greenpeace

Greenpeace was always perceived as a group of action and images while it works in a narrower spectrum of issues. It has an activist approach that is more in battle with the governing bodies seeking immediate action to its campaigns. Greenpeace has always relied on the support of its members that volunteer to participate on the various activities without actually providing access to the structural and organizational set up of the organization.

Greenpeace's website has established a climate homepage that allows to develop a debate with industry on the issue of climate change. Also it has a list of what an individual can do to promote climate change and how the pressure form the public can influence science, policy and politics. Greenpeace has established a European Unit office in order to have a more direct influence on the EU political institutions. Regarding climate change, the Greenpeace European Unit wants to increase its campaign and it has jointed several projects with other European environmental organisations. Additionally, Greenpeace has connected the climate change to other campaigns, such as the Antarctic campaign to ensure the integration of this issue in other areas of the environmental agenda.

Greenpeace has identified global climate change as one of the greatest threats to the planet with little real action being taken to address the problem. Therefore, it is campaigning for governments to face up to their responsibilities and urgently address this problem. Governments should be leading the way to a fundamentally new energy direction based on clean renewable energy, like wind or solar power. But instead, many governments support the agenda of the companies which continue to spend billions of dollars on development of coal, oil or gas. Therefore, Greenpeace is campaigning against new oil exploration and has focused on halting oil exploration in two 'frontiers' - the Arctic in Northern Alaska and on the Atlantic ocean to the north and west of Ireland, Scotland and Norway.

Greenpeace also firmly believes that it can no longer be assumed that fossil fuels will cover the energy needs of the future. As a result, Greenpeace is campaigning for investment in renewable energy and is working closely with other NGOs and this issue.

World Wide Fund for Nature (WWF)

The WWF has always been and continues to be a charity concentrating on conservation and with a strong work on educational issues. In tactical terms, WWF works closely with industry and government agencies on various projects and it never had an anti-government approach. It is regarded as an NGO that works on sustainable development projects with educational initiatives. Environmental education plays a large part on the role of WWF as an NGO and this factor has been incorporated in the campaigns.

The WWF website is a good indication of the emphasis given to the issue of climate change by establishing the causes, impacts and solutions of climate change. It represents one of the main campaigns of WWF and it presents a variety of options for the individual to support the work of WWF regarding climate change. The recommendations for action are divided into 2 sections:

- the 'Act Now' options of joining WWF and supporting its work, writing to the MP and promoting further action for battling climate change, and
- the Alert Network which allows the public through emails to find out about the constant changes on the issue of climate change and it introduces new solutions.

WWF has also created a European Office in order to influence the EU institutions in their decision-making regarding environmental issues, such as climate change. WWF's priority is to reduce carbon pollution from industrialized nations through:

- publicising climate change agreements
- promoting partnerships with forward-looking businesses
- introducing national energy-saving and clean energy campaigns ensuring the effectiveness of the Kyoto Protocol.

Climate Action Network Europe (CNE)

The Climate Action Network was established in 1989 and its aim is to promote government and individual action to limit climate change to ecologically sustainable levels through the formulation of policy options and position papers on climate-related issues. It is divided in eight regional offices with Climate Action Network Europe (CNE) being the first Climate Network node. CNE was created as an NGO service on climate change issues managed by the Stockholm Environment Institute(SEI) and it acts also as a research centre for climate change information. In its effort to enhance the work being done regarding climate change, they have set up a library containing relevant information and distributes newsletters on the topic. CNE has also established a website to enhance its campaign that is mostly of an informative character.

Climate Network Europe (CNE) is a coordinating office, based in Brussels, for environmental groups in Western Europe working on climate change issues. It is a non-profit organisation receiving funding in the present financial year from Commission of the European Communities, the Danish Government, the Stockholm Environment Institute and the Swiss Government. CNE runs an information service on climate change and coordinates policy on climate change at a European level as well as liaising with other groups in the global organisation of Climate Action Network

Membership is open to all environmental non-governmental organisations that subscribe to the goals of CNE and are active in the field of climate change. Over the years the membership has been expanded and CNE plans to involve even more European NGOs. Today, Climate Network Europe has over 75 member organisations.

One of CNE's main tasks is to facilitate co-ordination of members' climate related work while at the same time co-operating with the other CAN focal points in Africa, South Asia, South East Asia, Latin America, the USA, Canada, Central and Eastern Europe. CNE builds partnerships with industries, trade associations, local authorities and other sectors of society on initiatives such as eco-tax reform, renewable energies and energy efficiency. The database of CAN NGOs and contacts is maintained at the CNE office and every two years an updated CAN NGO directory is published.

CNE monitors and encourages the implementation of policies and measures that combat climate change in the EU as well as working with national NGOs to do the same at the member state level. Work is done on all aspects of EU policies linked to climate change issues. This includes energy efficiency and standards, integrated resource planning, carbon/energy taxation, renewable energies and transport policy. See the publication on renewable energy for the latest policy paper in this area. CNE follows closely the negotiations on the UNFCCC and CNE members have been present at all official meetings along with ECO, the influential NGO newsletter published at the negotiations.

As it is indicated, even though all NGOs mentioned above work towards the same target which is the protection of the environment, they follow very different paths. While Greenpeace supports a strong fleet of boats and organizes great numbers of volunteers to participate and stage various protests throughout the world, FoE puts its efforts and funds into local group activities and ensure that extensive research is compiled for all of its campaigns. Finally, WWF puts most of the funds on conservation projects and promotes education of various issues. But all of these NGOs have obtained public support, promoted issues like climate change and gained the respect and cooperation of the EU through the use of the new media technology, the Internet, that allows direct link with the public. As it has been shown above, information technology has been used positively for the role and goals of NGOs and made NGO support accessible to everyone.

It is also worth noting that environmental groups have a unique political structure in Brussels. With an increasing use of professional and technical assistance to promote issues, NGOs are working in a rather institutional climate that constantly evolves and they exist within political structures where the mandates are not always clear. Therefore, they need to be flexible with a great skill of co-ordination. Environmental NGOs provide information and expertise that is valued by the EU institutions and used in order to legitimise their position They are also in direct contact with each other, allowing for a more co-ordinated and effective presence in the EU. Of crucial importance for all negotiations is the need for practical concessions to be made in order to secure cross-party support and to get an agreement with the Commission. This change in attitude has been noticed the past couple of years, as even within the EU decision-making bodies there is a more conciliatory tone towards the promotion of certain issues, such as climate change. The motivation is still very strong and although there might be disillusionment in some areas even Thilo Bode, head of Greenpeace International admits that: "We have made considerable progress.

Air quality has improved, rivers have become cleaner, waste disposal is better controlled." All is required is stronger action and Europe will deserve the mantle of environmental leadership.

However, the biggest obstacle still remains the implementation of the decisions and directives. Persuading the EU is only one step towards the implementation of all these decisions by the governments of the member states and moreover, the international community. The EU is only a battle of a greater and tougher war. 'Lobbying in the EC is like attempting a complex obstacle course at the end of which you could find yourself up against a silent, unassailable brick wall' (Bretherton & Vogler, 1997).

But the influence exerted by pressure groups is well-established, according to the European public relations organisation Entente International Communication. According to their report 'Putting the pressure on', 70% of leading businesses are targeted directly by pressure groups and the majority of them are directly involved in dealing with pressure groups and operate under legislation that the groups helped create. While the percentage is high for countries like Belgium, Germany and Austria, the UK and the southern European countries are less inclined to co-operate with pressure groups (Trapp, 1997).

The success of NGO pressure should be indicated on a long-term basis. It's fair to say that the environmental message has been heard over the past 25 years, and since its start, there have been successes: the creation of an environmental action programme, the inclusion of the environment in the regional policy and the continuous realisation that it is an integral part of the EU policies. But it is still a long way from the final victory. The theory of integration is not going to be 'put to flesh' as easily as it is hoped for. As well as ensuring that ministers in the areas of transport, agriculture, energy take account of 'green' considerations, finance ministers should be the ones to show that they are environmentally aware. Integration is the next step since environmental legislation is in place so now we need to look at environmental policy in other areas and ensure that environmental issues are given top priority during enlargement negotiations with the central and eastern European countries (Cross, 1998).

CONCLUSION

What is revealed through this paper is the need for joint implementation between NGOs and the EU decision-making bodies to ensure emissions reduction and a compliance with the Kyoto Protocol targets.

It is often indicated that NGOs along with the EU have set their sights too high during the UN Climate Convention and throughout all the COPs, but despite the slow action in implementing stringent measures, progress is happening and it would not have been possible without the presence and influence of NGOs. The complexity of the climate change issue at a political and scientific level remains the main reason for the lack of a stronger strategy and immediate action. As long as strict targets and timetables remain absent, climate change will remain an environmental issue that will only escalate and will not disappear. The challenge is greater than it is realised and it does not affect only the climate. An effective policy regarding climate change requires changes in all sectors and as the EU has been promoting in the 5th EAP, integration of all relevant sectors in a key factor in battling climate change. NGOs have been talking about the need for further integration but it is up to the decision-makers of the EU to ensure the implementation of such integration. It must be noted that such remodelling is a long and painstaking process that needs to take into consideration the long-term benefits of environmental protection and the short term concerns about economic development and international competitiveness.

Unfortunately, contemporary international politics indicate the tendency to wait for others to take the initiative and this is taking place within the EU leading to a continuous postponement of any concrete action regarding climate change, a factor that is facilitated by the doubts that surround the scientific certainty of this phenomenon. The absence of fully visible signals of climate change only strengthens scientific uncertainty and postpones any future agreement. In other words, it is awareness of climate change and its impact that can ensure the success of a climate policy. Therefore, NGOs must ensure that scientific uncertainty is reduced and stringent measures are implemented regarding the reduction of greenhouse gas emissions. Their role is to ensure that the public and the governing authorities comprehend that despite the incompatibility of environmental and economic concerns, there can not be an economic growth if there is no environment. Therefore, sustainable development must be the way forward. ❑

FOOTNOTES

1. For full details on the Kyoto Protocol and the emissions limits see ww.cnn.com/SPECIALS/1997/global.warming/stories/treaty/index4.htm
2. CO2 refers to all greenhouse gas emissions expressed as carbon dioxide equivalents.
3. The six gases are: carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O) and the 3 halocarbons-hydrofluorocarbon (HFC), perfluorocarbon (PFC) and sulphur hexaflouride (SF6).
4. Every country is given a number of credits and the countries that can reach the Kyoto target without using up their entire allocation, can sell them to other states. The country that buys the credits can offset them against its own target without setting strict policy measures.
5. For more details see the EEA multi-annual work programme 1999-2003.
6. Article 3 states that: "Parties should protect the climate system for the benefit of present and future generations of humankind, on the basis of equity and in accordance with their common but differentiated responsibilities and respective capabilities".
7. ALTENER I budget for 1993-7 was 40 million ECU and for 1998-9 was 30 million.

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A Municipal Role in Climate Change

Azzah Jeena

ABSTRACT

Communities have a real contribution to make to climate protection. Up to half of Canada's greenhouse gas emissions (350 million tonnes) are under the direct or indirect control or influence of municipal governments. Community-wide emissions can be influenced through land-use, transportation and community energy planning, building codes, permits, building retrofits, water conservation and storm runoff management programs, as well as improved waste diversion from landfills and incinerators.

It is estimated that from now to 2008, municipal governments could contribute between 20 to 50 Mt of greenhouse gas reductions from initiatives aimed at municipal operations and the community. It is true that when municipalities reduce greenhouse gases they also save money, cut local air pollution that leads to smog, acid rain and health problems, create jobs and stimulate community economic development. These often are referred to as the multiple benefits of greenhouse gas reductions. At the community level, however, the local benefits are the real drivers behind municipal participation in the Partners for Climate Protection (PCP) Program, a partnership between FCM and the International Council for Local Environmental Initiatives.

FCM believes that until climate change is integrated into an overall focus on communities, human health, sustainability and quality of life that the kind of progress needed to slow climate change will not occur. Therefore, the focus of PCP is community sustainability.

To support this focus, FCM is establishing a Sustainable Communities Department to support its existing programming on climate protection, energy efficiency and energy alternatives and the addition of the Green Municipal Enabling and Green Municipal Investment Funds. The Department's vision is: Living a better quality of life through sustainable community development.

Achieving the Sustainable Communities vision is supported by three primary program objectives:

- *secure explicit senior management and council support for action;*
- *influence institutional decision making; and*
- *secure and retain champions.* ❑

Public Education and Outreach to Reach Canadians: The Federal Perspective

Neil McCleod

ABSTRACT

Climate change is possibly the single greatest environmental challenge we as a society face. Public education and outreach is essential to make Canadians more aware of, and give them a greater understanding of, climate change; to encourage Canadians to take action to reduce emissions in their own lives; and to support other measures initiated as part of the National Implementation Strategy.

Public opinion research indicates that Canadians want to act to reduce emissions, but need to know what they can do. The Government of Canada has undertaken several public education and outreach initiatives to help Canadians understand climate change and how to act to reduce emissions, including the Climate Change Action Fund and programs to help Canadians reduce their energy consumption at home, at work, and on the road. ❑

A Scientist's Role in Communicating Climate Change

David Henderson and Fred Herfst

ABSTRACT

The Canadian Climate Program Board (CCPB) is a multi-stakeholder, multi-disciplinary body that serves as the focal point for climate system science, impacts and adaptation (SIA) activity in Canada. While its primary function has been that of an advisory body on SIA matters, the CCPB embraces its mandate of informing and educating Canadians on climate change and variability.

Through the involvement of the CCPB in preparing the SIA Options Paper for the National Climate Change Process, the Board became sensitized to the value for scientists becoming more involved in climate change communications. This lead to inclusion of a special chapter Making Informed Decisions *and recommendations in the Options Paper which articulated the Board's vision of the sorts of messages and vehicles which could be employed to increase the effectiveness of the climate change communications to Canadians.*

The Board is currently examining how it can most effectively advance this vision through an outreach program focused on two streams - one for the general public and the other for decision-makers. To guide the development and the implementation of the strategy the Board formally created an Outreach Advisory Committee. This body is in the process of defining an array of activities that could be undertaken under these two streams.

The Climate Change Communication Conference provides an excellent opportunity to:

- *informally discuss climate change communications with a range of experts to define what "works and does not work";*
- *further define the emerging niche of the CCPB as a communicator of the science of climate change; and*
- *establish potential partnerships with other like-minded organizations.*

The Conference also provides an opportunity for the CCPB to present in a workshop setting its collective experience in climate change communications and its near-future plans in this area. More specifically the workshop will seek to test and obtain feedback on the foundation principles, as noted in the SIA Options Paper, and its upcoming Executive Briefing Series for the Special Reports of the Intergovernmental Panel on Climate Change (CLIMEXEC). Some of the areas where the Outreach Advisory Committee seeks additional input are:

- *pitfalls and considerations for scientist communicating climate change*
- *audiences*
- *key messages to be communicated to audiences*
- *vehicles for communications.* ❑

Session A4

NATIONAL & REGIONAL COMMUNICATION STRATEGIES 1: INITIATIVES FROM THE US NATIONAL ASSESSMENT

Engaging Stakeholder Participation in Assessing Regional Impacts from Climate Change: The Mid-Atlantic Regional Assessment
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Developing Scientific Methods, Tools, and Prototype Products for a North American Assessment of Vulnerability to Climate Variability and Change
Benjamin Felzer and Robert Harriss
National Corporation for Atmospheric Research (NCAR), Boulder, Colorado

Overcoming Barriers in the Use of Climate Information
William A. Sprigg
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Engaging Stakeholder Participation in Assessing Regional Impacts from Climate Change: The Mid-Atlantic Regional Assessment

Ann Fisher, James Shortle, Robert O'Connor, and Bud Ward

The US National Assessment's stakeholder participation objective requires raising awareness about how climate change might affect stakeholders as individuals or as members of organizations and communities. An initial Mid-Atlantic Regional Assessment (MARA) workshop summarized climate science and the role of the news media. It also elicited stakeholder concerns about potential impacts. A diverse MARA Advisory Committee comments on draft outlines, scenarios and reports; some members have become formal assessment collaborators. Such dialog can enhance efforts to raise awareness among their constituencies, with communication about climate change becoming both "bottom-up" and a "top-down" exchange.

INTRODUCTION

Stakeholder participation is an exciting component of the US National Assessment process, reflecting the trend in devolution from national government to regional and local levels (e.g., The Presidential/ Congressional Commission 1997). This component also is challenging, because there is little experience to confirm or refute competing conceptual approaches for involving stakeholders in assessing regional impacts from gradual global changes. The literature contains few models that would explain why one approach might be more effective than another (O'Connor and Bord 1994; Chess and Hance 1994; Fisher et al.1995; Chess and Purcell 1999). Instead, most of the literature fits into two categories. One category contains descriptions and occasional evaluations of stakeholder participation in assessment; most of these are related to solving current local problems that are highly salient to citizens. Examples include where to locate a waste facility or highway, minimizing water quality and odor impacts from concentrated animal feeding operations, or determining whether an apparent cancer cluster is real (e.g., US EPA 1990). The second category consists of "guidelines" based on what has seemed effective but without much conceptual basis to explain why (e.g., Lundgren 1994, US EPA 1997).

It is comparatively easy to identify stakeholders and engage their participation when a local issue is highly salient and actions can yield results relatively quickly. In contrast, stakeholder engagement in the US National Assessment requires attention to a complex issue with many uncertainties and with impacts that might not be evident for 30-100 years—long beyond the planning horizon of most individuals, businesses, and organizations. The literature has little to offer, either conceptually or descriptively, about stakeholder participation in such assessments. One exception is recent work by the European ULYSSES and CLEAR projects, using series of structured focus groups to explore the issues of climate change and energy use (Kasemir et al. 2000). A second exception is in-progress activities by components of the US National Assessment, one of which is described here. This paper takes a step toward filling the literature gap, by describing how the Mid-Atlantic Regional Assessment (MARA) has involved stakeholders. The assessment process still is underway, so this paper attempts to draw insights from understanding the status of stakeholder participation in the MARA; a formal evaluation of its effectiveness would be premature.

The US National Assessment (2000) is the United States' first attempt to synthesize impacts at a national scale from global environmental change. The US Global Change Research Program (USGCRP) recognized that impacts of climate variability and change will differ across regions; some (but not all) of the processes regulating vulnerability to climate change operate at regional or local scales and could be missed in aggregate studies at the national or global level. Thus the USGCRP has been collaborating with federal agencies to sponsor 16 regional assessments (including the MARA) that span the nation and its territories, as well as nationwide assessments of five cross-cutting "sectors:" coastal areas and marine resources, fresh water, agriculture, forests, and human health.

STAKEHOLDER INVOLVEMENT OBJECTIVES

The overall goals of the US National Assessment are to identify:

- how people and their surroundings are affected now by climate variability and how they will be affected by climate change,
- how individuals and communities can take advantage of opportunities and reduce vulnerabilities resulting from climate variability and change, and
- what additional information and research are needed to improve decision-making related to impacts from climate variability and change.

To accomplish these goals, a primary objective has been active participation by stakeholders in the assessment process, especially at a regional level. This objective implies a broad definition of stakeholders: everyone who might be affected by changes in climate and its variability. For a regional assessment, those most likely to be affected are the people who live in the region. Figure 1 shows the parts or all of eight states that comprise the Mid-Atlantic Region for this assessment. Other stakeholders include people who do not live in the region but who own at-risk property or visit there, or have values for its special places even though they might not intend to visit them. For the MARA, stakeholders are defined as those who might be affected by climate change in the MAR or who might make decisions based on output from the assessment.

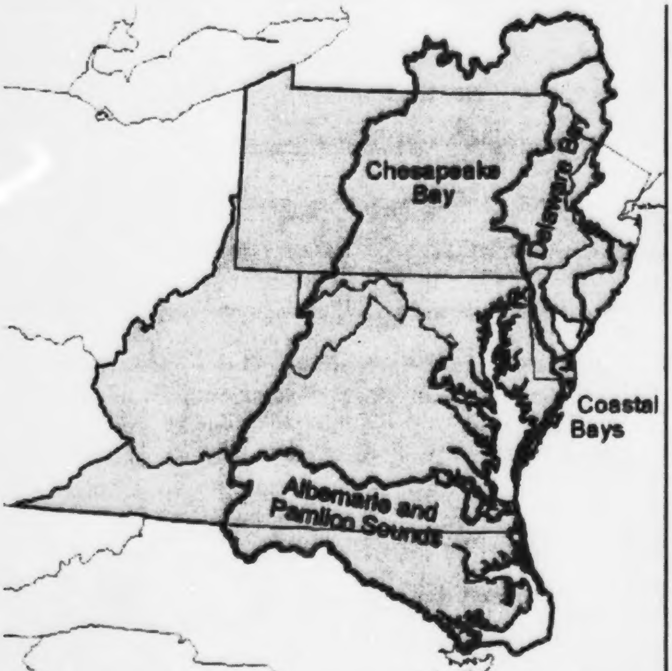

FIGURE 1. The MAR, With Major Watersheds.

The MARA team identified six goals for stakeholder involvement (O'Connor, et al. 2000):

- **Helping identify assessment questions that address stakeholder concerns.**

Stakeholder input can help set priorities for which impacts to assess and which impacts will receive more in-depth assessment. Interactive communication with stakeholders is the only way to identify potential impacts of particular concern to them.

- **Enhancing the assessment's technical quality.**

Stakeholders sometimes know about or have access to data otherwise not available to the core assessment team. Whether as citizens untrained in technical disciplines or as scientists, stakeholders sometimes can identify gaps or biases in the methods or data sets—early enough to make adjustments.

- **Providing a forum for sharing ideas among stakeholders with diverse constituencies.**

Meetings of the Advisory Committee provide a non-adversarial setting; focusing on the science and the process of the assessment can lead to discovering unexpected areas of common interest.

- **Making the process more legitimate to third parties.**

Broad stakeholder involvement enhances the credibility of the assessment process and its findings. Engaging a broad group of stakeholders makes it more difficult for critics to assert that the results would have been different if others had been included in the process.

- **Improving stakeholder awareness of potential impacts as well as adaptation strategies.**

Participating in the MARA process should build stakeholder knowledge about both positive and negative potential impacts related to climate change and about options for taking advantage of opportunities or coping effectively with damages.

- **Facilitating dissemination of assessment findings.**

Stakeholders can help by informing their own constituencies and by advising MARA regarding dissemination strategies such as public information opportunities.

STAKEHOLDER INVOLVEMENT PROCESS

An initial step was to set up a 17-member Steering Committee that helped in planning the September 9-11, 1997 workshop. Steering Committee members represented public interest groups, industry, state and federal government agencies, river basin commissions, and other universities. Workshop goals were to summarize scientific agreements as well as uncertainties and the role of the news media in communicating about climate change. Even more important, the workshop elicited stakeholder input about what types of potential impacts they could envision or were of concern. Participants provided input through a questionnaire mailed before the workshop. They received background papers that summarized the available literature on what the impacts might be for the MAR. This information was reinforced by plenary sessions. During working group and summary sessions, more than 90 participants identified issues that would deserve special attention in an assessment of potential regional impacts from climate change. They provided additional feedback in a follow-up questionnaire mailed after the workshop. (Results from the workshop are summarized below in the section on how stakeholders affected the MARA.)

While awaiting authorization to conduct an assessment, the MARA team kept in touch with the September 1997 workshop participants and others who had expressed interest. Upon receiving the go-ahead, we established a stakeholder Advisory Committee to ensure interactive communication would be a routine part of the MARA. The intent was to form an Advisory Committee small enough to focus constructively on a set of important issues

TABLE 1. Advisory Committee Members

Category	Number
Citizens Groups	25
Business and Industry	19
State and Local Governments, Commissions	22
Federal Government Researchers	13
Academic Researchers	13
Total	***92***

yet large enough to represent the groups likely to experience substantial impacts in the region. The recruitment process was informal and inclusive, building on groups participating in or identified at the 1997 workshop. Drawing upon individuals and organizations that had expressed skepticism about global warming as well as those that support actions to reduce greenhouse gas emissions, we recruited representatives from business and industry and experts from research organizations. To keep the size manageable, we did not recruit elected officials. However, every individual who has sought to participate has been welcome to join the Advisory Committee. Table 1 reports the distribution of Advisory Committee members.

The Advisory Committee is not expected to be statistically representative of the MAR stakeholders, but to reflect a range of stakeholder perspectives related to the region's potential impacts from climate change. We expect the differing levels of involvement across stakeholders to reflect their judgment about the importance of potential impacts for perspectives such as theirs.

Stakeholders have access to information about the MARA through its web site: (http://www.essc.psu.edu/mara/). This web site is updated frequently, provides contact information as well as a link for stakeholders to provide input to the MARA team, and links with related sites.

A second (June 1998) workshop elicited input from researchers knowledgeable about climate change science. Nearly 40 university and government researchers exchanged information about state-of-the-science resources (e.g., data sets, studies, expertise) that the MARA team might use for assessing regional impacts from climate variability and climate change. This meeting also included interaction about potential structure and process of the MARA.

Because researchers are only one category of stakeholders, an October 1998 meeting (with 65 participants) elicited the full Advisory Committee's input about what research questions should be addressed. At its May, 1999 meeting with 63 participants, the Advisory Committee gave feedback on the draft preliminary assessment and initial advice about displaying findings, developing materials, and disseminating the assessment results to a wide audience. Their suggestions also were input for planning next stages in the assessment.

Meetings among Advisory Committee members have the advantage of providing a forum for discovering common interests, understandings, and concerns related to the impacts of climate change in the Mid-Atlantic region. However, they are time-consuming and expensive. Thus more routine exchanges take place approximately bi-monthly (using e-mail, fax, regular mail, or telephone calls), with updates on the MARA team's progress, requests for feedback on drafts ranging from very preliminary outlines of research questions to formal comments on the supporting Foundations document (Fisher et al. forthcoming), or occasional information about the US National Assessment or related science announcements.

Table 2 summarizes how often and why Advisory Committee members have been contacted in writing (since the

TABLE 2. Outreach to Advisory Committee

Purpose/Time Period	Number
Through October 19-20, 1998 workshop:	8
On scenarios, vignettes, outlines, draft chapters, agenda and through May 1999 workshop:	15
On April 1999 draft preliminary report:	6
On September 1999 *Overview* draft:	6
On March 2000 *Overview*	4
On April 2000 *Foundations* draft:	2

TABLE 3. Stakeholders provision of substantive input/feedback

Purpose/Time Period	Number
On scenarios, vignettes, outlines, draft chapters, agenda and through May 1999 workshop:	31
On April 1999 draft preliminary report:	16
On September 1999 *Overview* draft:	49
Volunteered feedback on final *Overview*:	21
On April 2000 *Foundations* draft:	22
Miscellaneous exchanges:	93

formal start of the MARA on May 15, 1998); the table omits telephone calls and contacts about meeting logistics. Many of the contacts have included stakeholders beyond the formal Advisory committee; Table 3 summarizes their responsiveness.

Interactions with stakeholders reinforced our earlier findings about people's perceptions of global climate change and its potential impacts (O'Connor et al. 2000). Most people are aware of global warming, but it ranks below their concerns about issues that affect their daily lives and about other environmental issues (Bord, Fisher and O'Connor 1998). This lack of salience explains much of the challenge in achieving sustained interest and participation in the MARA process.

HOW STAKEHOLDERS AFFECTED THE MARA

This section addresses how stakeholder input helped in choosing what to assess. The following section identifies how stakeholder input has helped in displaying and disseminating results.

USGCRP guidance to the regional teams stressed the need to focus on issues or topics for which the impacts—whether beneficial or damaging—were expected to be largest and most important for that region. USGCRP also recommended choosing a small set of topics for which the assessment would be "do-able," in terms of having data and methodologies available in time to be useful for the US National Assessment.

A first step in choosing assessment topics for the MARA was to prepare background papers summarizing the literature on what the impacts might be for the region. These papers and the USGCRP guidance suggested that the MARA team focus on fresh water, forestry and agriculture; these sectors are sensitive to current climate and we expected data and methodology to be available for a timely assessment. However, a second initial step was convening a September 1997 workshop to share the most up-to-date science about potential regional impacts and identify potential impacts of concern to stakeholders (Fisher et al. 1999).

Although our earlier research found that global warming is not salient for most people, it indicated a sense of unease about potential impacts ranging from health impacts to ecological impacts (O'Connor et al. 1999; Lazo et al. 1999). This information, along with USGCRP guidance, the background papers, and the advice of our Steering Committee, led to choosing the following impact categories for working group sessions at the 1997 workshop:

- economic growth, industry and commerce (including energy and transportation)
- ecosystems
- water resources (quantity and quality)
- natural hazards
- human health
- agriculture, forestry and fisheries

Participants were divided into six working groups, each of which devoted nearly six hours to its topic during the 2-and-a-half-day workshop. Two surprises emerged. First, there was much more concern than anticipated about potential health impacts from climate change. Second, although this workshop focused on the watersheds draining into the Chesapeake and Delaware Bays, workshop participants expressed a lot of concern about impacts in coastal zones—for the Mid-Atlantic Ocean coastal areas as well as for the Bays.

Continuing contact with the Advisory Committee, especially at the October 1998 workshop, demonstrated constancy of concern about potential health and coastal impacts. Largely as a result of the stakeholder participation process, the team added health impacts (which we expected to be less sensitive to climate in the MAR) and coastal impacts (which we expected to be much more of an issue in other regions). Thus the set of impacts examined in the MARA include forests, agriculture, fresh water quantity and quality, coastal zones, human health, and ecological impacts as a cross-cutting issue.

The Advisory Committee also encouraged the MARA team to address issues of uncertainty as clearly and comprehensively as possible. This comment led to segmenting the *Overview* summary figure into sections showing the confidence in projections, as well as to additional attention to this issue throughout the document.

The MARA Advisory Committee has been invited to provide input to workshop agendas, draft outlines on what to assess and what methods to use, scenarios for analysis, and draft reports. The nearly 50 sets of comments stakeholders provided for the *Overview* draft suggests that they recognize how important the MARA team considers their input to be. For instance, responses to each comment received on that draft are documented in the section of the web site that has the final *Overview* (http://www.essc.psu.edu/mara/results/overview_report/index.html). Advisory Committee members have been encouraged to share information among themselves as well as with the assessment team. One result has been the identification of additional experts to provide input or review of MARA plans and interim products. Another result has been to convert a few Advisory Committee members into formal collaborators in the assessment process.

CHALLENGES IN DISSEMINATING RESULTS

Our earlier findings that global warming is not salient suggests that most stakeholders are unlikely to seek actively for information about how climate change might affect their community 30-100 years from now. A key session at the 1997 workshop, "How the News Media Report on Environmental Issues," provided reporters' perspectives on the decline in news coverage of the environment. (Fisher et al. 1999; a summary can be viewed at http://www.essc.psu.edu/ccimar/). Their frank statements about the requirement that news media make a profit suggested the need to develop a suite of dissemination strategies for assessment results. They also reinforced the need for presenting results in ways that would be useful to potential usersBranging from reporters to individuals deciding whether the renovate their beachfront home to government officials faced with decisions about ensuring future water supplies. Thus one challenge is finding effective ways for getting people's attention to information that they currently do not view as salient even though it might be useful input to (individuals', organizations' and communities') decisions affecting the long-term future.

On the other hand, our earlier research also demonstrated that people are aware that they lack knowledge about potential impacts from global warming, and are receptive to information about such impacts (Lazo, et al., 2000). Many MARA Advisory Committee members demonstrate this receptivity by continuing to provide input about next steps and feedback on interim and final products. As indicated in the "Process" section, we solicited stakeholder input about what information they wanted, and what formats would make the information most useful. The essence of their recommendations is that they want access to lots of information about potential regional impacts of climate change, in many formats, with all of them easy to understand and use.

So far, we have responded to this challenge primarily by setting up the MARA (2000) web site and producing the *Overview* (Fisher et al. 2000). Within two months of releasing the *Overview*, about 1400 copies had been distributed. It can be downloaded from the MARA web site, along with selected high-quality figures.

Another response is input to the Environmental Health Center's bi-monthly newsletter, *Climate Change Update*. This newsletter reflects "what the private sector...is...saying and doing in the context of potential climate change and the issues affecting and being affected by it" (*Climate Change Update*, Vol 1, No. 1, pp 1-2). Intended for a broad lay audience, the newsletter is sent mostly to businesses and journalists. Relatively few journalists view regional impacts of climate change to be grist for a news story, but we respond promptly to their requests for information.

We also obtain peer review of our work through presentations at scholarly conferences and submission to professional journals. For example, the May 2000 Special Issue of *Climate Research* has 11 peer-reviewed articles about the MARA.

As time is available, we accept invitations to summarize the results for public groups. We also describe our methodological and procedural steps for others in the US National Assessment, at meetings and in publications such as *Acclimations* (which are available on the US National Assessment web site).

A second challenge occurs because the MARA is one among several regional and sectoral assessments being conducted as part of the US National Assessment. The overall assessment process has placed constraints on releasing results, because of the need for careful peer review to ensure the scientific credibility of the methods and data used in the assessment and because of sensitivity to timing and consistency with the National Assessment Synthesis Team (NAST) *Overview* report. The NAST *Overview* is expected to be released for public comment in June, 2000. Anticipating this release, several public-interest non-governmental organizations (NGOs) have been preparing two-page summaries of regional and sectoral assessments, of the US National Assessment process, and (when it is released) of the national synthesis results. These are intended for Congress and for journalists, and will be distributed through a web site. The MARA team has been collaborating to ensure the scientific accuracy of the two-pager for this region.

A third challenge arises because although the MARA team has a wide range of disciplinary skills, their primary expertise is for research and assessment. Outreach could be enhanced by targeting particularly vulnerable subregions or groups, with strategies and materials especially suited to their needs. Ultimately, the information should be made available to planners at the community and corporate level, in formats that make it clear why the information is useful for the decisions they are making. The lack of resources makes it infeasible to add formal outreach expertise to the MARA effort. Our primary thrust will be to continue the outreach activities that have been initiated, especially through distribution of the *Overview* report and its back-up *Foundations* report (Fisher et al. forthcoming). An short summary flyer has been designed; we hope it will be printed soon for wide distribution. Hopefully, the Advisory Committee and other stakeholders will find this useful and assist in its dissemination.

NEXT STEPS

Stakeholder participation can be improved by integrating stakeholder input into new assessment activities. Based on what the MARA team has learned from the initial assessment activities, we propose to widen the scope of stakeholders involved, using focus groups and surveys of vulnerable places and peoples.

For selected subregions, we intend to explore stakeholders' perceptions of how actions today affect future landscape environment, health and ecosystems. This enables ascertaining how much people are willing to sacrifice now to reduce future risks. Sacrifice can be identified in terms of higher prices for goods and services, longer travel times for preferred activities, support for government policy, and inconvenience or discomfort. Such analysis will allow, for example, testing the hypothesis that people are willing to sacrifice more (now) to moderate ecosystem impacts than to moderate health impacts (that they perceive to be of comparable magnitude). This could occur if they perceive that technology enables faster advances in health care than in ecosystem restoration. Then they could expect medical technology to continue its current trend and thus judge it more important to reduce ecological risks because ecosystems can take a long time to rebound once damaged and the technology for ecosystem restoration has advanced only slowly. Additional hypotheses will be based on input from the focus groups.

We expect to frame the issues in terms of quality of life perceptions and environmental management options, conveying that government agencies want to know what citizens think should be done for the future of their own area. Instead of the government coming in and telling people what they have to do or should do, this study is asking people what tradeoffs they are willing to make to provide for different landscape environments in their future. This approach has proven successful in Cape May, NJ (O'Connor and Bord).

Such in-depth stakeholder involvement can supplement approaches similar to those used by Kasemir et al. (2000). It will provide a base of knowledge about integrated regional assessment as well as potential local impacts from climate change. It can yield a guiding structure for using similar kinds of information to assess impacts from other stresses. As has been the case throughout the MARA, we shall continue to rely on the Advisory Committee and other stakeholders to ensure that we are exploring potentially important questions and that the results are presented in a way that is useful to those who need them. ❑

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http://www.essc.psu.edu/mara/results/overview_report/index.html, accessed May 30, 2000.

Developing Scientific Methods, Tools, and Prototype Products for a North American Assessment of Vulnerability to Climate Variability and Change

Benjamin Felzer and Robert Harriss

The first U.S. National Assessment has provided invaluable lessons on the future interactions between the climate modeling and impacts communities. There must be ongoing communication between the climate modeling, impacts, and stakeholder communities, to ensure that each community understands the needs of the others better. Climate scenarios other than GCMs must also be explored in greater detail to make them more user-friendly to the assessment community. Finally greater international cooperation, particularly within North America, is desirable, both to pool together our common resources and to more effectively deal with cross-border climate issues.

INTRODUCTION

Climate scenarios of the future are used by the climate impacts and assessment communities to determine the potential consequences of climate change and variability for impacts and vulnerability analysis. Scenarios describe alternative plausible futures that conform to sets of circumstances or constraints within which they occur (Hammond, 1996), not forecasts or predictions. The current U.S. National Assessment of the Potential Consequences of Climate Variability and Change (hereafter referred to as the National Assessment) has involved a wide community of stakeholders and scientists to determine the impacts and vulnerabilities of changes in temperature, precipitation, and other climatic variables on regions and (economic) sectors within the U.S. Traditional members of the climate impacts community includes crop modelers, hydrologists, and ecologists, who are using climate scenarios to determine the impacts of climate change and variability on the future of agriculture, water resources, and forests, respectively. More recently, the socioeconomic impacts of climate variability and change have become integrated into the assessment process. Many scientists within the climate impacts and assessment communities are not climatologists and are therefore not familiar with the nuances and details of the climate data and information. Completion of the National Assessment has required a network of people to assist the assessment community in understanding how to use and implement climate scenarios. In spite of these intense efforts, a wide range of studies with great potential for regional impacts, such as regional climate model experiments and ensemble analyses, has only started to be explored. It is clear from experience gained in the first National Assessment that a scientific toolkit of assessment methods, usable by a wide range of stakeholders, will be essential to making progress in future assessments.

Climate scenarios can include specific General Circulation Model (GCM) scenarios to simulate the future, historical data to project present trends into the future, sensitivity analyses to determine the impacts of different possible scenarios, analogues of past climates, and expert judgement. Both the GCM and historical data must be provided to the impacts community in an easily accessible and usable format. Guidance on how to use the data, the source of the data, and the meaning of the data are a prerequisite to their effective use by the assessment community. Climate modelers have often been unable to provide this type of directed support of their products due to the demands of their research. Additionally, the translation of climate information for assessment applications needs to be done by a multidisciplinary group that understands both the fundamentals of climate science and the extensive scholarship that has been done on constraints to the effective use of climate information.

The UK has set up a system to facilitate communication and information between the climate modeling and impacts communities via the LINK project at the Climate Research Unit (CRU). The Canadians are currently discussing a similar type of initiative, following a workshop last year on the need for coordinated climate scenarios within the Canadian impacts community. No such plan currently exists in the U.S. The likelihood of a continuation of assessment activities within the U.S. Global Change Research Program (USGCRP), as well as the continuing research efforts of impact scientists, increases the necessity for a continued and more cohesive means for effectively and efficiently linking their results to users needs. The potential for increased cooperation on North American-wide assessments would also be better facilitated with a more intensive U.S. approach. Furthermore, policymakers who rely on the results of climate modeling and assessment studies would benefit from a more centralized and analytic source of expert interpretation and advice. This note describes a set of activities that would help prepare future impacts and assessment researchers and other stakeholders for using climate scenarios, tools, and methods for impacts and vulnerability analysis.

STRATEGIC TASKS NECESSARY TO PREPARE FOR A FUTURE NORTH AMERICAN ASSESSMENT

1. **User's Guide or Primer**: There is a need for a User's Guide or Primer to discuss the use of climate scenario information for impacts and assessments. Such a document would include a discussion of what constitutes a scenario, how scenarios differ from predictions, and criteria for choosing climate scenarios. It would also include specific details about GCM scenarios, including a discussion of how GCM data are used for impact studies and how these data are downscaled to provide regional climatologies. Sources of uncertainty within the GCM scenarios would also be covered. While many of these issues have been discussed at a technical level in other articles, a document is needed for the general user (e.g. impact scientists who are not climatologists) with specific examples and applications for the assessment community. This document would review lessons learned about the development and use of climate scenarios in the first National Assessment and would be updated as needed into a leading guide to climate information for non-specialists. Earlier examples of this type of document include those of Cohen (1991) and Robock et al. (1993).

2. **Synthesis of Lessons Learned from the First National Assessment**: More efficient integration and use of climate scenarios in future national assessments will require a thorough review of the use of climate scenarios in the current National Assessment. Important, and often controversial, issues for the first National Assessment have included the rationale for including GCM scenarios, the criteria for selecting the specific GCM scenarios, the method of downscaling these data for regional analyses, and the process of providing these data in a timely manner to the regions, sectors, and synthesis teams. Another issue has been the analyses of these GCM data, with respect to climate diagnostics of the scenario anomalies (model differences or ratios between the future and modern baseline period), model validation, and model intercomparisons. A review of the first National Assessment might be undertaken by polling each of the regions, sectors, and National Assessment Synthesis Team (NAST) to determine the successes and failures, as well as suggested changes, to enhance the use of climate scenarios for future national assessments.

3. **Modeling Tools and Data Access:** The world wide web (www) has become a crucial means of providing easy access to climate scenario data. For the current National Assessment, www access has been coordinated centrally from the National Center for Atmospheric Research (NCAR), linking other sources of data onto a central www page. In the future this system needs to be maintained at a more permanent, dedicated location. The new information center will need to develop strong communication links with other data centers, including the Data Support Section (DSS) at NCAR, the EOS-WEBSTER project at the University of New Hampshire (UNH), Intergovernmental Panel on Climate Change (IPCC) Data Distribution Centers (DDC) and other mirror sites, the climate modeling data facility at Lawrence Livermore National Laboratory (LLNL), and the historical climatology data facility at the National Climatic Data Center (NCDC).

4. **Baseline Climatologies:** Scenarios developed for input to impacts models require some combination of observed baseline climate data and climate model perturbations. There are many possible choices for baseline

data sets, such as the Vegetation Ecosystem Modeling and Analysis Project (VEMAP) data sets, data from the Historical Climatology Network (HCN), and other gridded climatologies, as well as new ones being developed. There are also several methods for combining the climate model perturbations that need to be explored, including the use of deltas vs. ratios and the incorporation of the model variances. Creation and evaluation of baseline climatologies for use with scenarios is an important contribution to the impacts community.

5. **Model Analyses:** Analyses are needed of existing model data [e.g., from DOE Parallel Climate Model (PCM) and NCAR Climate System Model (CSM)] to help determine which scenarios to use and to assist the impacts/assessment communities who are using specific scenarios understand their limitations. While we must first establish the criteria for selecting which GCMs are the most appropriate (as mentioned in 1 above), validation of the GCMs is one of the potential criteria. A major shortcoming of the current National Assessment is that most model analyses, which could have been crucial to determining the choice of GCM scenarios, were not completed until the end of the National Assessment (with the exception of the contribution from Doherty and Mearns early in the National Assessment in 1998). These analyses include model validation of the 20th century, model and ensemble intercomparisons, and model diagnostics to determine the dynamical and thermodynamical processes behind the climate anomaly patterns. These types of analyses show what projected changes are the most robust and which are the most uncertain.

New scenario and model development have already gone far beyond the GCM scenarios used in the first National Assessment. For example, newer simulations use GCMs without flux adjustment, with multiple greenhouse gases and sulfate chemistry models, and new scenarios of sulfur emissions. More recent greenhouse emission scenarios also include policy scenarios that consider the effects of stabilization of CO_2 in the future. Scenarios of anthropogenic changes in land use, which have not been considered in current GCM simulations, are also being considered. Further model validation work already underway includes determining the effects of volcanic eruptions and solar variability on the climate of the 20th century. Only a few modeling groups at this time have had the resources to run multiple ensembles. Regional climate modeling efforts toward scenario development is also in its infancy and has the potential to provide scenarios at resolutions high enough to provide regional detail.

6. **Review and Synthesis of Information on Adaptation Strategies Used in North America:** It has been increasingly recognized that future assessments should include a comprehensive evaluation of impacts and detailed consideration of both mitigation and adaptation strategies for reducing socioeconomic and environmental consequences of climate variability and change. Much of the scholarship on mitigation and adaptation strategies is conducted by social scientists. The disciplinary "gap" between the physical and social aspects of climate impact science is closing, albeit slowly. The NCAR Environmental and Societal Impacts Group (ESIG) can form a network of major institutions developing knowledge and tools on past and present adaptation strategies that have the potential to reduce impacts of climate variability and change. Such a collaborative might maintain an up-to-date catalog of metadata on adaptation strategy studies organized in a bioclimatic framework.

7. **Historical and Paleoclimate Data:** There needs to be an intermediary between the groups gathering and compiling the historical data, for e.g. NCDC, and the impacts community who are using these data to develop scenarios of the future. Scenario development depends upon using the appropriate and significant historical trends within the correct context. Paleoclimate analogues are also useful for understanding future possibilities, but the user must be aware of the different forcing mechanisms responsible for climates of the distant past. Spatial analogues of the present can also be used more to help policy-makers understand the implications of climate change for a particular region. Observations of daily variability can be incorporated into GCMs or other scenarios using weather generators, producing data that can be used directly by many impact modelers.

8. **North American Linkages**: It would be useful to develop North American linkages through workshops, incorporating Mexico, Canada, and different U.S. modeling and impacts groups. The Canadians have already thought about establishing a climate scenarios center for the Canadian impacts community and have expressed interest in coordinating this effort with future U.S. Assessments. Related impacts studies along the U.S./ Mexican border would be facilitated by a North American-wide effort. Workshops can be organized for the North American climate scenarios and impacts communities along the lines of the ECLAT-2 project in Europe. There is also a need for greater communication and cooperation between NCAR, Geophysical Fluid Dynamics Laboratory (GFDL), and Goddard Institute for Space Studies (GISS) and other climate research groups in order to ensure the most efficient use of resources and information amongst the U.S. climate modeling groups.

9. **Public Outreach:** Coordination with the USGCRP on the preparation of educational materials for the public about climate models, climate scenarios, climate impacts, and the results of the first National Assessment would help inform the public. Besides providing support to the scientific and technical communities, it is vital to communicate accurate information about climate scenarios and models to the public, both to support the existing National Assessment releases and to prevent misinformation from disseminating throughout the public discourse.

10. **Stakeholder Dialogue:** An ongoing dialogue with selected private sector stakeholder groups would keep the line of communication open between the scientists and public for the future. This effort could focus on professional organizations and leadership groups that represent major sectors of the North American regional economy (energy, construction, transportation, tourism, etc.). Stakeholders have been an important component of the current National Assessment. Because the stakeholders are often more interested in the general nature of climate scenarios than the details, we could prepare special material for these groups to help them understand the results of the current National Assessment and to better involve them in future assessments.

11. **Weather and Climate Impacts:** We should develop stronger links between the weather impacts community and climate change assessment researchers. One of the most important research needs coming out of the current assessment is the need for better short-range weather forecasts, which are used by the weather impacts community. Because our knowledge of long-term climate change impacts is based upon shorter-term weather impacts, we can help facilitate better communication and interaction between these two groups. Now is an excellent time to stimulate an interaction between sectors of the atmospheric sciences that will benefit the academic community across the nation.

EXAMPLES FROM THE U.S. NATIONAL

VEMAP Downscaling

The approach taken in the current National Assessment has been developed by VEMAP (Kittel et al., 1995, 1997; VEMAP Members, 1995). First a high resolution climatology of observed data for the U.S. (minimum and maximum temperatures and precipitation) was developed by interpolating station data to account for topography using the PRISM model. Daily data were then derived using a weather generator, and humidity and solar radiation derived from the daily data. Future model deltas of monthly minimum and maximum temperatures and ratios of monthly precipitation were then applied to the 1961-1990 observed baseline values. Daily data and humidity and solar radiation were then derived in a similar manner for the future as for the observed period using the monthly temperatures and precipitation. The primary scenarios used in the National Assessment are an approximation of the IS92a 'business-as-usual' scenario (1% increases in equivalent CO_2 with IS92a sulfate aerosols). The results of this 'downscaling' are shown in Figure 1 for winter precipitation trends, where the coarse CGCM1 resolution (Boer et al., 1999a) has been effectively smoothed to a half degree resolution. This process in effect imprints the present-day signature of topographic climate onto the climate model anomalies of the future. By using this common VEMAP data set, the National Assessment has ensured that most impacts modelers have used data processed in the same way.

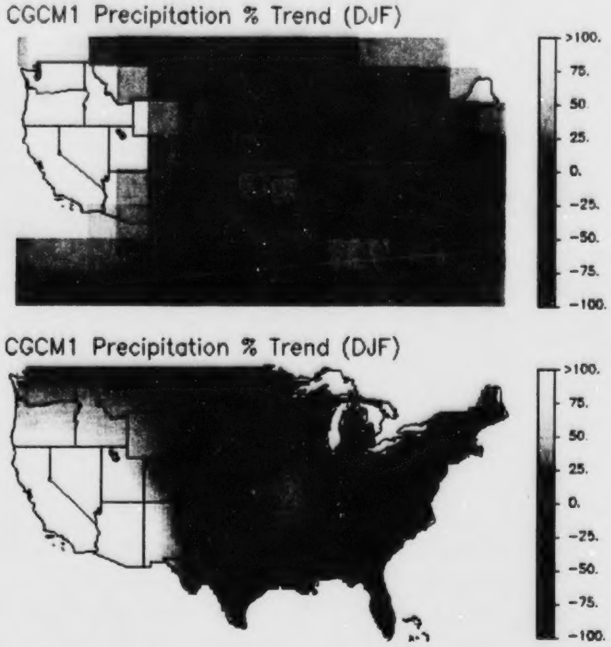
CGCM1 Precipitation % Trend (DJF)
>100.
75.
50.
25.
0.
-25.
-50.
-75.
-100.
CGCM1 Precipitation % Trend (DJF)
>100.
75.
50.
25.
0.
-25.
-50.
-75.
-100.

FIGURE 1: Projections across the US of the changes in annual precipitation over the next 100 years (percent change per century) from the Canadian Model Scenario (top) directly from the model at 3.75°x3.75° resolution and (bottom) processed by VEMAP at 0.5°x0.5° resolution.

Model Biases

The model biases for winter precipitation (Boer et al., 1999b) during 1961-1990 (Figure 2) show that the coarse resolution GCM cannot reproduce precipitation patterns in regions of high topography, such as the U.S. West. In particular, the Cascade and Sierra Nevadas are not high enough in the model to prevent precipitation from reaching further eastward into the Rocky Mountain West, resulting in too much inland precipitation in this region and too little along the West Coast. Dry biases throughout the Eastern U.S. are largely the result of errors in storm tracks and land surface processes. Models with the fewest biases are not necessarily the best ones to use for predicting the future, because one way to reduce model biases is to hold constant more physical parameterizations, which will limit the feedback effects that are crucial to understanding the climatic response to increased greenhouse gases or other boundary condition changes. Regional biases in temperature and precipitation may also not be as important as biases in the large-scale circulation, which may play a larger role in determining the resulting anomalies. Finally, it is possible that the anomalies are correct even if the biases are large, an assumption that underlies the VEMAP approach.

Model Intercomparisons

Model intercomparisons (Figure 3) show how the primary models used in the National Assessment, CGCM1 and HadCM2, compare to a range of other models using similar scenarios. The Canadian model is the most sensitive model to increasing greenhouse gases. While the more recent HadCM3 shows as much warming over the U.S. as the CGCM1, the newer NCAR models show much less warming. The Canadian model is in the midrange of precipitation increases projected for the U.S., while the HadCM2 model is at the high end of the range. Providing such an envelope of model projections enables us to understand the relative response of each model (Hulme and Jenkins , 1998). Although we might try to ascribe a probability to the likely climatic

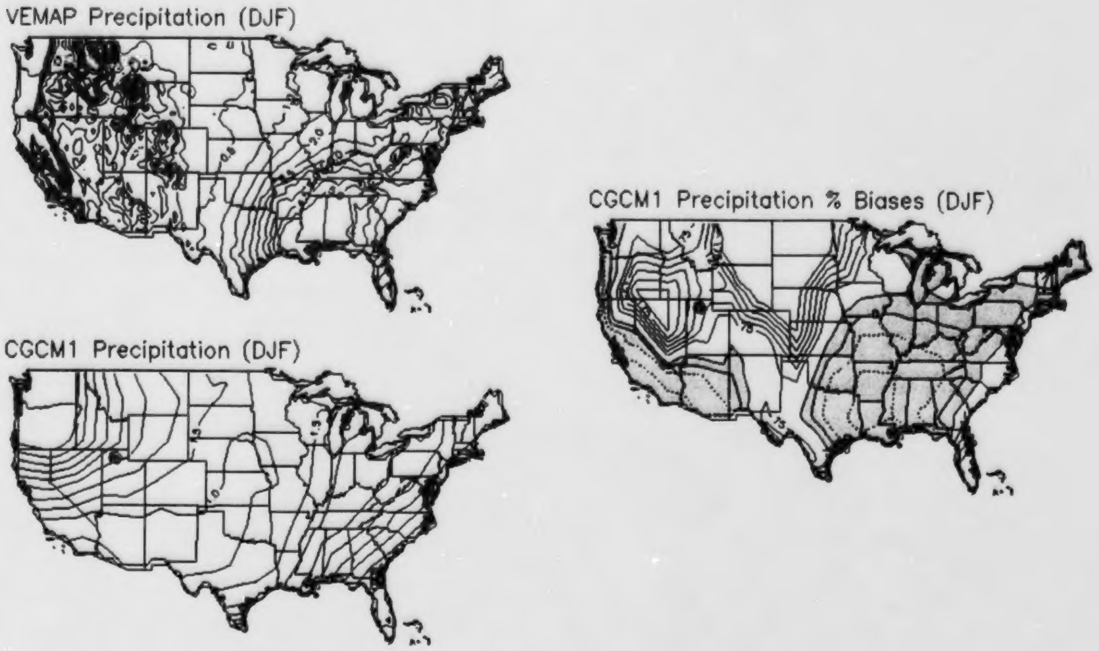
VEMAP Precipitation (DJF)
CGCM1 Precipitation (DJF)
CGCM1 Precipitation % Biases (DJF)

FIGURE 2: Comparison between (top, left) observed December, January, February (DJF) precipitation and (bottom, left) CGCM1 DJF precipitation for 1961-1990, and the (right) difference obtained by upscaling the observed precipitation, subtracting, and then smoothing. Shading indicates percents less than 0.

response based on a range of model scenarios, even total agreement between the models would not necessarily imply the correct response. Furthermore, care must be taken to ensure that the comparisons between different models are the same because of the differences (in many cases slight) in the emissions scenarios.

Model Diagnostics

Climate diagnostics involves understanding why models are producing their particular response. Understanding why two models show opposite responses in the same region can help us understand the likelihood of that response. In many cases, the same physical process occurring in slightly different locations will lead to drastically different outcomes for a particular region. The likelihood of the final outcome depends on the accuracy of the physical processes responsible for that outcome. For example, analyzing changes in winter storms (Figure 4) in the Canadian model can tell us something about the precipitation trends (Figure 1) and changes in climate variability (Felzer and Heard, 1999; Lambert, 1995). The major storm track in the northeastern Pacific strengthens and shifts southward in the future, allowing more storms to penetrate further south along the Pacific Coast, coinciding with the increased precipitation trends for this region. This result is consistent with results from several other models, in some cases relating to increased El Ninos or El Nino-like conditions (Meehl et al., 2000). In addition, the storm track along the East Coast of the U.S. weakens significantly towards the end of the 21st century, contributing to the reduced precipitation in this region. This reduction in East Coast storms may be expected from the reduced land/sea temperature gradient along the East Coast in winter, resulting from greater heating of the land than the ocean. Because storm tracks are a measure of the daily variability of low pressure systems, they are one way of gauging changes in climate variability as opposed to climate means. The changes in variability or extremes are often more important than changes in the climatic means in terms of the future impacts to society.

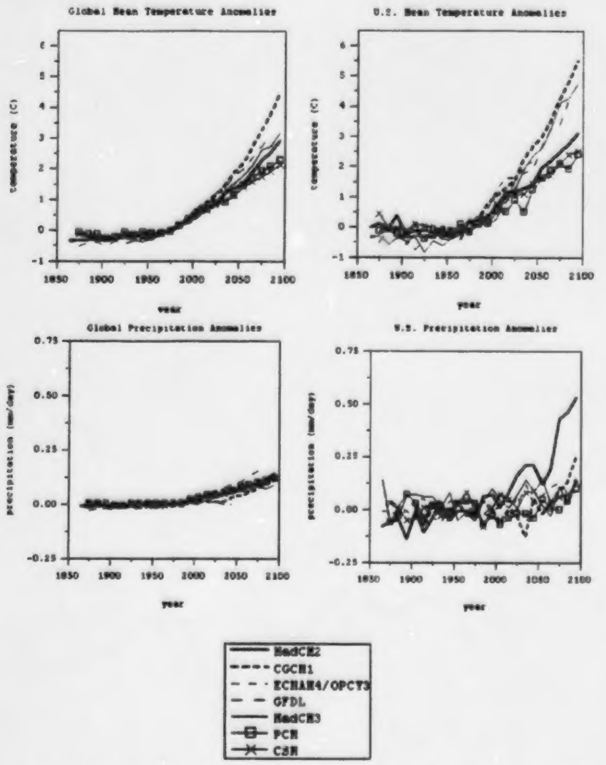

FIGURE 3: Comparison of the annual average changes in (top, left) global average surface air temperature (°C), (top, right) average surface air temperature (°C) over the US (bottom, left) global average precipitation (mm/day), and (bottom, right) average precipitation over the U.S. (mm/day) from the Canadian Model Scenario (bold, dotted) and Hadley Model Scenario (bold, solid) simulations used in the National Assessment and from the simulations of other modeling groups, including a very recent result from the Hadley Centre model version 3 (solid), Germany's Max Planck Institute (dashed), NOAA's Geophysical Fluid Dynamics Laboratory (long dashes), and from the Parallel Climate (solid with boxes) and the Climate System (solid with crosses) models at the National Center for Atmospheric Research, the runs for which actually used a lower sulfur emission scenario than the others. Decadal means have been plotted to suppress the natural variability of year-to-year conditions.

Model Ensembles

Model ensembles provide one method of assessing model uncertainty. An ensemble is a model run with different initial conditions but the same boundary conditions. The CGCM1 scenario used in the National Assessment has included three ensemble runs. The difference between the ensemble mean and the particular member of the ensemble used in the National Assessment (Figure 5) shows that the differences between different ensembles are small relative to the positive or negative direction of the change (Felzer and Heard, 1999). The large increase in precipitation in the Southwest is not as large in the other ensembles, yet the decrease of precipitation in the Southeast is larger in at least some of the ensembles. Some have proposed using ensemble means rather than single realizations as the best guess projections for the future. However, using the ensemble mean implies both filtering out the climate variability that is such an important component of climate impacts and limiting the ability to diagnose the underlying dynamical reasons for the resulting anomalies. Another way of looking at model uncertainty is to analyze the variability of an unforced control simulation, which provides a measure of the model variability. This model variability can then be compared to the climate anomalies for a given forcing to determine if those anomalies are statistically significant.

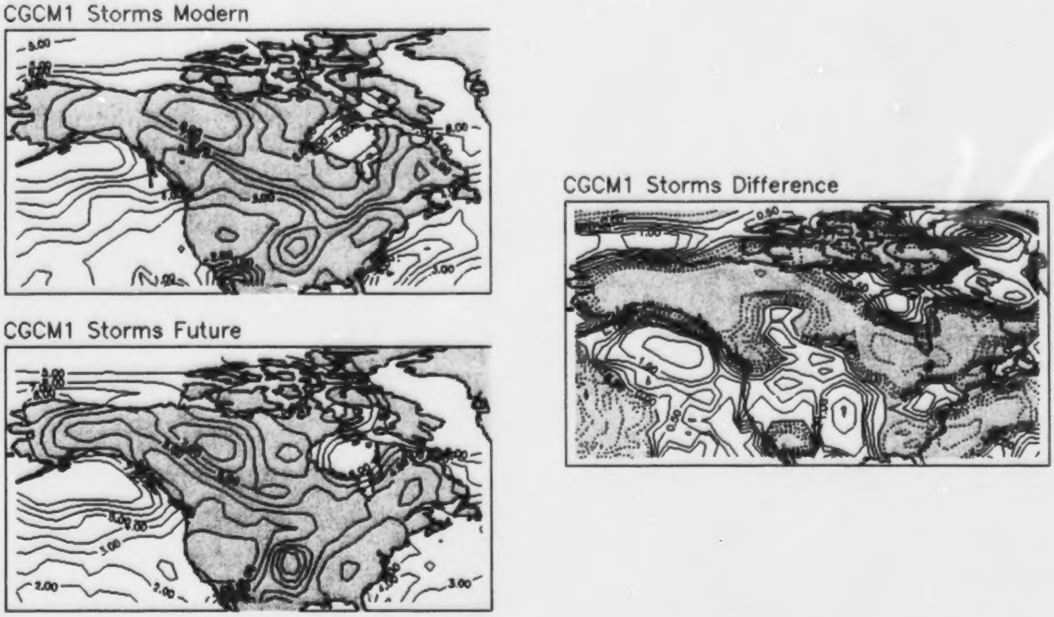
CGCM1 Storms Modern
CGCM1 Storms Future
CGCM1 Storms Difference
3.00
2.00

FIGURE 4: DJF storm counts from the CGCM1 for (top, left) 1901-1910 total; (bottom, left) 2091-2100 total, and (right) the difference, b-a. Units are number of winter storms per 145,000 km2. Shading for absolute storms represents continental landmasses; shading for storm differences indicates decreased number of storm events.

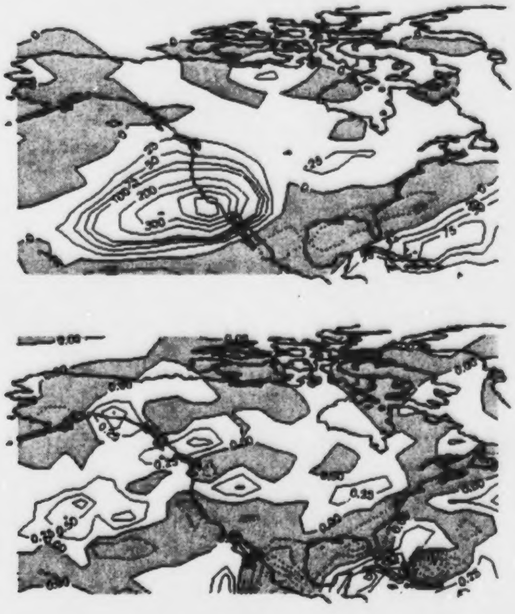

FIGURE 5: CGCM1 ensembles of precipitation ratio between 2090-2099 and 1961-1990 {done as percent as [(future-modern)/modern*100]} for (top) DJF, ensemble mean and (bottom) DJF, ensemble 1 – ensemble mean. Shading indicates percents less than 0.

CONCLUSIONS

The following goals would enhance our ability to prepare the U.S. and North America for future national assessments: a) provide a source of communication between the public, stakeholder, impacts, and modeling communities, b) form a center for analyses of observational and climate model output, c) document key information about using climate scenarios for climate impacts, and d) provide a North American center, linking the U.S., Mexican, and Canadian climate scenarios efforts.

To achieve these ends, it would help to establish a climate information center in the U.S. as a place where impacts and assessment researchers and other stakeholders can go to for help in using climate scenarios, tools, and methods for impacts and vulnerability analysis. It would also help to establish an advisory committee to bring together members of the stakeholder and scientific communities. This group could help set the priorities and goals for developing climate scenarios for the impacts and assessment communities. An advisory committee would provide more formal input from the larger communities outside the information center and a more formal structure for addressing the issues and enhance communications between the different groups. ❑

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Overcoming Barriers in the Use of Climate Information

William A. Sprigg

The Potential Consequences of Climate Variability and Change in the Southwestern United States (in review) is part of a national study that should help target environmental information most useful in coping with climate variability and change. A workshop held in Tucson, Arizona in September 1997 helped identify important social and economic functions and environmental resources that were climate dependent. This workshop helped assemble a multidisciplinary team of people who would collaborate in the National Assessment and explore ways in which to obtain environmental information and improve its use and its economy of production. This paper summarizes some of what has been learned, what obstacles must be overcome, and what more must be done to expand the use of climate information in particular. Specific examples in providing climate information to benefit public services are cited.

INTRODUCTION

A National Assessment on the Potential Consequences of Climate Variability and Change is currently in public review and scheduled for official release in mid-2000. The National Assessment is comprised of studies defined by geographical region and by crosscutting social, economic and environmental issues. The Southwest region study (ISPE, in review) that is the basis for the present paper is one such contribution. The draft report is available for public review at http://geo.ispe.arizona.edu/research/swassess/. The overall aim of this assessment is to provide information useful to managers, decision-makers and policy-makers in the home, business or public office. However, between this assessment and the use of it lie many barriers. The study is a proving ground for understanding what these barriers are and how to get over them.

KEY BARRIERS

Potential beneficiaries of climate information may be unaware that climate can affect their lives in ways that can be managed. Anticipating this, a workshop was held to discuss the ways in which climate might affect the health and wealth of people in the Southwest (Merideth, et al., 1998). One hundred participants from business, industry, state and federal government and academe attended. It was an opportunity to link the providers of information with potential users, or stakeholders. This was a start to overcoming an early barrier, namely, not knowing whether climate information can affect how we do business or run our lives.

The workshop helped to address another obstacle, *the often-stretched link between the source of information and the user.* Several such links were reaffirmed during the workshop, by bringing back together people who had worked previously with each other. However, most were meeting other participants for the first time. The link, to be sustained, needs frequent exercise, particularly over the first few barriers it will face. Establishing an institutional link is often not enough. Typically there are many false starts in attempting to *define the climate information product that best suits the users needs*, another obstacle that requires the "push – pull" of negotiation, the forwarding of an idea and the suggestion to modify it. Not much of this can be accomplished in a first meeting. The user and the supplier must believe that defining a product, perhaps only a test product, is worth the time spent. There are many successful cases, (e.g. the Salt River Project and Bureau of Reclamation participation in the NASA Regional Earth Science Applications Center at the University of Arizona) some of which might be considered groundbreaking. An example of the latter occurred just after the U. S. National Climate Program was signed into law in 1978 (Carter, 1979).

Scientists at Lamont Doherty Earth (nee Geological) Observatory and the University of Mexico were testing a climate model to forecast monthly mean temperatures for cities in the U.S. Northeast and upper Midwest. The Niagara Mohawk Power Company, purchasers of large quantities of gas used in heating homes and businesses in the region, could use these forecasts profitably if they were shown to outperform "climatology," upon which they based an upcoming season's fuel requirements. Purchasing gas for future needs was a gamble: buy too much, you suffered storage costs and lost access to funds; buy too little, your customers' businesses closed. The U.S. National Climate Program Office brokered a test of the LDGO model. The National Weather Service provided current weather data and climatological records. The Niagara Mohawk Power Company compared their theoretical financial gains and losses using the LDGO forecasts with the gains and losses actually realized applying standard company practice. The statistical sample of test cases included hindcasts made of the previous decade of winter months and real-time forecasts over two consecutive winters. The results convinced company management to install a forecast capability within the company. With continued links to the NWS for data and to LDGO consultants, the company's forecast unit assumed responsibility to provide parallel means of anticipating gas purchase needs. Postscript: within a few years of establishing the forecast unit, the need for such forecasts diminished because changes in the laws governing access to fuel providers took much of the gamble out of advance purchases.

The power company experience reveals several lessons. One is that climate impacts on a business can sometimes be made almost trivial by a simple act of law. But, the fact remains, the company gained by using a climate forecast technique that, in the beginning, was highly questionable. Niagara Mohawk had to overcome several barriers to using a new climate information product. The company permitted one of its employees to work closely over more than two years with government and university scientists, not because of altruism, but because the potential return on this investment in time could be very large. The link was established. The barriers overcome in this instance are very similar to the ones being encountered in many other potential applications revealed in the Southwest Assessment study.

Once the first hurdles have been overcome, *each potential stakeholder or user requires some critical level of confidence in the reliability of the assessment.* As in the case of the power company, the stakeholder must make this judgement with the cooperation of those who conducted the assessment and often with the assistance of a third party. Questions are often asked: How many principal stakeholders were involved and what was the variety of stakeholders' operations coming under study? Were second- and third-order impacts determined? Were scientific methods applied? This means that *the climate information, the stakeholders' potential applications and the assessment itself must be understood.* In the case of the Southwest Assessment, the answer to whether the information, applications, and the assessment were understood, depends on the level of interaction among study participants. The study of the Arizona fresh water supply (Carter, R.H. et al., 2000), carried out over a year with the same investigating team probably has resulted in high marks for understanding. The Southwest Assessment's integrated urban study, far more complex and with far less interaction among principals, scores low in understanding and, thus, readiness for practical application. The Arizona water study permitted examinations beyond the first-order impacts of variability in water supply and use. The urban analysis has barely scratched the surface of first-order impacts and precious few of their interactions. The Arizona study has a strong link between providers and users of information. The necessary urban links are generally temporary, easily frayed or, more commonly, nonexistent.

Applicability of climate information to a particular problem must be identified. User interest fades quickly if the potential use of the information is unclear. For example, it was not at all obvious that the prototype monthly temperature forecasts produced by the LDGO model would be useful to Niagara Mohawk Power Company. Stockholders and company management may understand and forgive a situation in which a futures purchase, when it is based on long-standing company practice of using climatological averages from the official government record, proves unwise. Company management is much harder on the individual who errs when using new and untested information, particularly coming from something as controversial as climate prediction. Thus, the team of experimenters had to know the steps taken in applying the new information, the people who would apply it and the stakes in a success or failure. This leads to another of the hurdles to overcome: *The impacts of using (or not using) the proffered information product must be known and appreciated.*

A period of testing a product and evaluating its intended impact is advised. Such tests may suggest changes in the climate product, such as time of issue and its content or appearance. Tests could suggest modifications in the way the climate product is applied. This is one of the steps that maintains a strong link between supplier and user. It develops confidence in the ability of the supplier to continue the partnership, which is particularly essential if non-traditional products and applications are at issue. Stated another way, *"Will the information under test today be available in the future?"* If the current supplier cannot be relied upon to continue the partnership, is there an alternate source for the information needed? This is an important barrier. Getting past it is necessary if a continuing reliance upon the product is foreseen.

The Assessment of Potential Implications of Climate Variability and Change in the Southwestern United States included climate scenarios for the 21st Century produced by two state-of-the-art numerical models of the global climate system (Doherty and Mearns, 1999). The models attempt to incorporate realistically all significant influences on climate, including projections of atmospheric concentrations of heat-trapping trace gases such as carbon dioxide. Assessment team members from academe and industry, in business and in economics, were very aware of the model shortcomings. They largely played down the usefulness of the scenarios in their written statements about possible implications of climate change. Thus, another barrier to use of climate information was exposed: *the credibility of the basic data or information used in creating the new product* or, in this instance, the assessment. Greater emphasis was given to historical records of climate, some of which were derived from proxy climate indicators such as tree rings, and indicate significant periods of climate quite different than today (Sheppard et al., 1999).

The research community has been the "supplier" of information for the Southwest Assessment. Much of that information is derived from observation systems and data repositories maintained by government agencies. Data sources, such as the National Climatic Data Center, the National Weather Service, the U.S. Geological Survey, the Department of Energy and NASA are vital, yet their links with new and important stakeholders and developers of value-added products are, with some exceptions, ephemeral. Stakeholder partnerships, links formed during the assessment, can lead to greater application of climate information for coping with climate variability. How well this is done will depend on the attention given to *maintaining the links between data sources, researchers and stakeholders* that were established during the assessment. Failure to do so is potentially the most important barrier to future applications. ❑

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Session B1

CLIMATE CHANGE PERCEPTIONS 2: THE PUBLIC

Ten Illusions That Must Be Dispelled Before People Will Act On Your Global Warming Message
J. Marshall Gilmore
EQuality Model Communications

Perceptions and Understanding of Climate Change in Sri Lanka (A Case Study)
Prabhath Patabendi
Sri Lankan Team for Disaster Prevention and Sustainable Development (Team DPSD)

Public Perception of Climate Change, the Precautionary Principle and Public Policy
Peter Berry
Health Canada

Ten Illusions That Must Be Dispelled Before People Will Act On Your Global Warming Message

J. Marshall Gilmore

The object of global warming communications is to make the audience aware of the issues and dangers of global warming to induce changed behavior addressing these potential dangers. However effective these communications may be, the audience returns to their everyday world dominated by certain physical sensory and policy illusions that work against them actually taking action to mitigate global warming. Designing global warming oral and written presentations to include direct and unambiguous explanations about these illusions and their potential effects will help militate against their dilatory effects. Changing these misperceptions is crucial to changing behavior.

INTRODUCTION

The tremendous adverse impacts that could result from global warming have been publicized in the media ranging from the cover of Time magazine to CNN television programs and yet people fail to take appropriate action to address this threat. One of the primary reasons is the impact of certain common sense perceptions people have deeply imbedded in their interpretation of the physical world around them which have been derived by and are reinforced by their everyday sensory observations of the physical environment around them. Much of our perceptions of our physical world are derived from visual sources. "Fifty percent of the cortex of the brain is thought to be devoted to processing visual information, indicating a profound, evolutionary commitment to a vision as a means of joining inner and outer conditions"(Sewall, 1995, p203). These imbedded perceptions along with certain misperceptions regarding scientific and economic policy work against a person taking action even after being told of the serious implications of global warming. A comprehensive study by the Pacific Northwest National Laboratory of the sociological aspects of decision-making regarding choices related to global warming found that "choices are embedded and intertwined in social institutions of all kinds, including interest groups, pressure groups, lobbies, elected officials, citizens, and so on. Choices are often so deeply entrenched in societal norms that people will resist persuasion and coercion aimed at changing their behavior" (Rayner et al, 1998, p4). Policy illusions, on the other hand, deal with misperceptions derived from and supported by distortions in media, political, economic and other institutional policy. So even though you inform a person of the dangers that global warming presents, when they leave your lecture hall, put down your book or finish watching your video, they reenter their world filled with sensory common-sense and learned policy messages that constantly contradict or at least water down the impacts of your message. Any communications designed to motivate remedial actions must meet head-on and explain these discrepancies and apparent contradictions.

SENSORY-BASED ILLUSIONS

The scientists several hundred years ago had the same problem in getting the general population to accept the fact that the Earth was round or that the Earth revolved around the sun. People's physical senses as well as their learned understanding of their environment simply told them otherwise. The same type of sensory-based misperceptions work to discount the message science is telling us about the dangers of global warming. This first category of general misperceptions is the most difficult to deal with and includes the following general concepts.

1. Vastness of the Atmosphere.

The observed atmosphere seems to be immense relative to any impact humans might have on it on a global scale. It is easy to accept a local or even regional impact such as smoke from a burning forest fire but to imagine the human population changing the content of the Earth's entire atmosphere defies the sensory perception of the enormity of both the Earth and its atmosphere. In order to begin the change the audiences imbedded and constantly reinforced view it is necessary to create images of the thinness of the atmosphere relative to the size of the Earth. Photo images from NASA space exploration can begin this process as well as using the comparison of the skin of an apple relative to the total apple. In that people can easily visualize linear distances, an effective tool is to point out the distance between two well known landmarks in their location that are the approximate equivalent of the depth of the atmosphere. Explain that by the time they have traveled the distance between these two landmarks they have run out of atmosphere.

2. Daily, Seasonal and Yearly Temperature Variations as Compared to the Projected Average Temperature Increase Resulting From Global Warming.

Your audience already experiences temperature variations on a daily basis of up to 40 degrees Fahrenheit and seasonally up to over 100 degrees. They also experience colder or milder winters from year to year that may vary by 30 to 40 degrees Fahrenheit. This variance in temperatures we have become used to makes the announcement that the "average" temperature may go up by the expected 2 to 6 degrees seem quite innocuous. Communications must be clear on the impacts of a change in the "average" verses highs and lows and how that impacts the ecosystem. Depicting New York City under 1000 feet of ice during a time period when the average temperature was calculated to be only nine degrees cooler or a graphic image of the change in the coastline of some local geographic area familiar to the audience can begin to bring home the impact of a change in the average (Casten, 1998, p20). Mentioning a particularly offensive insect that will flourish if average temperatures change by 2 to 6 degrees is effective.

3. Temperature Changes Will Be Gradual and Small Allowing Adaptation.

Like so many forms of environmental degradation, the pace is so gradual and fragmented that we become acclimated to the changes without being alarmed by them. This reinforces the notion that any changes resulting from global warming will unfold so gradually and be so incremental that adaptation will be easy. Add to this the human experience that all prior global changes have unfolded over such geologically long time periods as to be imperceptible to humans. Global warming communications need to address two aspects of this misperception: that the rate of change projected, while it seems slow to the unaware observer, is geologically-speaking an extremely accelerated pace of change, and secondly, that nature experiences "thresholds" and is not strictly linear (Houghton, 1997, pp46-59).

Communications need to clearly depict the comparative rate of historical change and the projected rate of change we are forcing on the ecosystem now. On the other hand, the communications need to be able to explain that while the CO2 rates, temperature averages and other geological conditions have usually changed slowly over thousands and millions of years, that the Earth has experienced sudden changes as well (Houghton, 1997, pp56-60). This is the chaotic or threshold aspect of the changes. Most events in people's lives are perceived on a linear scale: miles driven in your car, hours and minutes passed, dollars earned (unless of course you win the lottery which would probably lead to lots of chaos). However nature is not always linear but rather can be very chaotic. Examples that illustrate the threshold concept graphically include lightning, earthquakes and avalanches. A climatic example may be the suspected change in the flow of the Gulf Stream away from Northern Europe that brought on a mini ice age some eleven thousand years ago and which took only some 50 years to complete and resulted in a 7 degree C change in average temperature (Houghton, 1997, p57). We do not know when a climatic threshold may be reached but we do know they exist.

4. "Warming" Is Not Such a Bad Thing.

This concept has been discussed several times in the context of what the global climatic problem should be referred to: global warming, climate change, climate disruption and so on. The reality is that the media and most indexed reports all now refer to the issue as "global warming" so to an extent, we are stuck with this reference. As the earlier discussions have pointed out, "warming" just isn't an alarming title that incites the population to take action. After all several really nice things are "warm": soup on a cold day, blankets, hugs, water in the pool and so on. Global warming communications must therefore counter this innocuous title with clear messages that "warming" in this context equals the potential nasty impacts we suspect could result: insect infestations, greater territory for disease exposure, extreme weather events, rising sea levels and market disruptions. Maybe we should call it "global swarming and global storming"!

5. We Have Made Environmental Mistakes Before and Lived Through It.

There is a common-sense historical perspective that includes the notion that humans have sure enough made drastic mistakes regarding their environment and paid the consequences. Events like deforestation, over irrigating and salinization of farm lands have devastated societies over history but never has there been an environmental mistake that has had a "global" effect such as is contemplated by global warming. Your audience therefore places your global warming scenario in the only context they have learned and assumes the degradation will be local or regional and that we can eventually fix the mistake. The global warming communication needs to counter this contextual bias with emphasis on both the "globalness" of this threat and the relative permanence of the changes in the climate we may be bringing on due to the effects of the oceans and the reaction of CO2 in the atmosphere (Houghton, 1997, p56). This "globalness" has two aspects to it: the first and obvious one that the climate of the entire Earth will be affected but also a second aspect that includes the fact that the different regional responses to global warming will have impacts on other regions as well, i.e. a flooding of Bangladesh will create refugees that may come to live in North America or the loss of the agricultural productivity of the US Great Plains will effect the amount of grains available to other countries. Global warming is in everyone's "back yard".

6. Our Technology Will Find A Quick Fix.

Of course we live in the age of technological miracles: space flight, vaccines, biotechnology and computing capacity. Accordingly there is a presumption that our scientists and engineers will simply come up with a "fix" for any problem our current technology might unwittingly create. The common application of this belief in the miracle cure of technology leads to inaction by your audience. The message needs to be twofold: it is the misuse of current technology that is causing excessive CO2 emissions but it is also the lack of use of existing appropriate technology that is available to us today that is exacerbating our problems. Current technology can be the "fix" to help prevent global warming not to fix after it has occurred.

7. Global Warming Is Too Big For Individuals to Make a Difference.

Another common response from an audience that has been presented with the impacts and threats surrounding global warming is inaction due to being overwhelmed. If the message gets through about the vastness of the problem, the potential permanency and the myriad adverse impacts, then there is an accompanying sense that only large institutions have the authority and resources to respond, not seemingly unempowered individuals. The global warming communication therefore must graphically present scenarios where the individual actions of people, added together, equal a powerful mitigating factor. The point can be made by showing how it is often the individual adverse actions of people that have caused the problem in the first place. If we can cause it, we can solve it.

POLICY-BASED ILLUSIONS

The second category deals with misperceptions derived from general policy treatment of global warming issues and includes:

8. You Can't Prove It's Happening Today So No Action Is Necessary.

Media depicts a scientific community engaged in hot debate over whether you can prove global warming is happening "today" as a result of man's activities by looking at the climatic evidence. While it is obviously important to know whether we are in fact already experiencing the impacts of global warming, that we might not now be able to detect the impacts should not be an excuse for failing to take actions to mitigate global warming.

Overemphasis of this debate creates a "red herring" argument that easily leads to taking no action at all. Due to the nature of climate change, by the time we can see obvious signs of man's impact on the climate, it may be too late to take effective action to prevent the worst impacts. The real issue is whether and to what extent global warming is going to happen. Global warming communications should clearly expose the nature of this debate and its importance in the context of the decision to take mitigation action.

9. Media Practices Distort the Numbers Concerning How Many Experts Support What Position and Fail to Inform Us About Financial Bias.

Current media practices encourage reporters to "get both sides of the story". If the relative sides are not correctly quantified and qualified as to funding or other bias, the media coverage leaves the audience with the impression that both sides are relatively equal. This is what has happened in the common written and electronic press regarding the global warming issue. The result is the audience thinks the expert community is roughly equally divided on the issue and therefore waiting to take action is justified. Add to this the fact that vested interest entities like coal, oil and gas companies have spent large sums of money supporting continued use of fossil fuels and opposing the concept of global warming and confusing the issues by blaming *el nino* or *la nina* events for all weather changes. This results in an overall distorted media experience (Gelbspan, 1997, pp39-41). Global warming communications need to clarify this discrepancy.

10. Addressing Global Warming Is An Excessive Cost When in Fact It is A Wise Investment Not Only For The Business But For The Economy.

This is undoubtedly the most devastating illusion and distortion that has been unwittingly created by the corporate opposition to those in favor of global warming mitigation actions. It has resulted from faulty economic models now thoroughly discredited by actual business practices and experiences that indicate that investments in technology that mitigate global warming are a boon not only to the implementing business but also to the economy(Hawken, 1999, p242). The faulty economic models took the narrow view of calculating only the dollar amount of the energy bill savings resulting from the new energy technology installed subtracted from the cost of the new technology (Lovins, 1997, p1). No consideration was given to the numerous collateral positive impacts that have caused the return on investment to be negative in some cases. These collateral impacts include such things as improved productivity, worker safety, decreased absenteeism and recruiting, lower insurance claims and costs, green marketing opportunities and product defect reduction (Romm, 1999, pp40-43). When these collateral beneficial impacts are considered, it is clear that the business implementing such mitigating technology is creating a leaner, more efficient, competitive and profitable entity.

The global warming message must also make it clear that not only is the implementation of these new technologies directly positive for its business and the economy at large but that there are other beneficial environmental, health and economic benefits. Many of the new technologies reduce other adverse air pollutants such as sulfur dioxide and oxides of nitrogen, and ground level ozone and particulates that adversely effect health and devalue property (Romm, 1999, p3).

The illusion of excessive cost is the most crucial misperception to alert your audience about. They are the decision-makers at the corporation, the shareholders or the consumers and in any of these roles, can impact the decision to invest in new mitigating technologies.

CONCLUSION

Global warming communications should go on the offensive against the above illusions that water down and defuse the call to take action. " Perception, consciousness, and behavior are as radically interdependent as the rest of our biosphere. Thus, perceptual shifts alter consciousness, consciousness alters behavior, and even unconscious learnings alter perception. Given our blatant need for ecologically conscious and consistent behavior, the development of skillful ways of seeing offers a direct path for consciousness intervention and behavioral change" (Sewall, 1995, p203). Don't leave it to the audience to overlay and contrast your message with the imbedded views they came into the room with. Tell them directly and unambiguously that some of your message will seem to conflict with everyday concepts they currently have and explain why. If your audience is alerted to what appears to be a conflict in advance, they will be empowered to accept the new vision and see through the illusion and most importantly, to take action. ❑

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Perceptions and Understanding of Climate Change in Sri Lanka (A Case Study)

Prabhath Patabendi

Sri Lanka is an island with a land area of 65,610 square kilometers. It is situated between the 5.55' and 9.51' N and 81.54 E. The mean temperature in most parts of the island ranges from 26th to 28 C. Rainfall occurs in Sri Lanka during the Southwest and Northeast monsoons.

Team DPSD has been conducting a participatory research study (case study) on current perception and attitudes of climate change in a small village in Southern Sri Lanka just 100 kilometers from Colombo, the capital of Sri Lanka. The study involves 500 villagers, and the majority of them are farmers.

The study will examine the current state of climate change understanding by stake-holders and their perceptions and attitudes. The study is the first of it's kind in Sri Lanka.

INTRODUCTION

Sri Lanka is situated off the southern tip of India just 29 km across at its narrowest point. With a land area of 65,610 sq. km, Sri Lanka is about the size of Holland and Belgium combined. The country has a tropical climate, but seasons in Sri Lanka bring almost unnoticeable temperature fluctuations. Seasonality primarily results from variations in the rainfall rhythm. But because Sri Lanka is a predominantly agricultural country, rainfall distribution over time and space is of great concern.

Climatologists divide Sri Lanka's climatic year into five seasons.

1. The convectional - convergence period (March to mid April)
2. The pre-monsoonal period (mid April to late May)
3. The southwest monsoon period (late May to late September)
4. The convectional cyclonic period (late September to late November)
5. The northeast monsoon (November to February)

Conventionally, Sri Lanka recognises two distinct climate regions, the Wet and Dry Zones, although precise demarcation is subject to academic debate. Application of the term "Dry Zone" to an area that receives over 1000 mm of rainfall can be misleading. This however tends to create a psychological barrier to human settlement and development of its resources.

In Colombo, the capital of Sri Lanka, the temperature ranges from 23°C to 36°C. In Nuwara Eliya, with plantations and mountains that reach up to 8,000 ft., the temperature can drop to 0°C. This variation is due to central highlands, which are surrounded by an extensive low land area.

Rainfall ranges from an annual average of 130 cm in Eastern Dry Zone to 350 cm in the West.

There are three main factors for climatic changes in Sri Lanka:

1. Depressions in the Bay of Bengal. It is estimated that when a cyclone develops in the Bay of Bengal, there is

only a 10% chance for it to come over to Sri Lanka.

2. Inter-monsoonal rain

2.1 Southwest monsoon rain. This brings the largest amount of rainfall to the southwestern lowlands and central highlands where some places receive over 500 cm.

2.2 Northeast monsoon rain. This has a weak and dry wind compared with that of the southwest monsoon. However, the northeast monsoon brings agriculturally significant rainfall to the northern and eastern parts of the country.

3. Deforestation (destruction of tropical forests). Large scale clearance of forests may lead to a reduction in water supplies and in fact, after the 10th century and 13th century, virgin forests in the mountain range were cleared by colonial settlers for tea plantations. Large scale settlement projects like the Mahaweli Development Scheme were also accountable for destroying thousands of hectares of virgin rain forest. It was revealed that the collapse of the Rajarata Hydraulic Civilisation in the 13th century was due to climatic change.

Sri Lanka can generally be described as a land of villages. Nearly 75% of the population live in rural areas, and we have 23,072 villages with nearly two million households. The economy is based on agriculture and climate plays a very big role in people's lives.

We, as a citizens' organisation, have been conducting a survey in Southern Province of Sri Lanka on people's perceptions and understanding of climate change. It was not completed, but a lot of interesting facts are emerging. The study is the first of its kind in Sri Lanka.

Nindana is a village in southern province, just 60 km from Colombo. It has about 1,500 households. One hundred per cent of the population belong to the majority Sinhalese community. The main agricultural crops are paddy, rubber and cinnamon.

We selected 500 households randomly out of 1,500. The methodologies used were :

1. Face to face interviews using a structured questionnaire.
2. An informal group discussion with an experienced moderator.

We have selected educated youth within the village and given them formal training in survey techniques, including interviewing methods and also knowledge about climate change issues. We are behind the scene but guiding them in a proper way.

The questionnaire is divided into four sections.

1. Socio-economic situation of the household
2. Impacts of climate change
3. Behaviourial intentions for actions to reduce the advance impacts of climate change
4. Ideas about public policies to address climate change

In sections 2, 3, and 4, we have specific questions.

1. What are the issues affecting you and your community
2. The impacts and proposals on policies
3. What are the issues affecting your country

The project is still on-going. We have held a few group discussions. It brings villagers together in small groups, with an experienced moderator to discuss key issues in a way that allows citizens to express their voice and raise questions. This will also give them an informal forum to express their ideas about climate change issues.

We believe that this is a very useful methodology, because it engages citizens on issues that affect their lives and their communities, and on the other hand, it provides rich and valuable information to decision-makers and policy makers about what matters to people.

What is emerging from this survey (although it is not completed) is interesting. Village people have comprehensive perceptions about the climate change issues in their community but they have less knowledge about climate change issues in the country.

For an example, people in the village understand and gain experience about flash floods at least twice due to climate changes, but are less aware such as air pollution from business and industry and destruction to tropical forest.

We have understood that their understanding of climate change is based on a few factors.
1. Historical base of experience maintained by this community (This community has a 1,500 year history)
2. Their living pattern based on rain-feed agricultural system

We found that many villagers state their willingness to support voluntary actions and government policies. Some citizens want changes in the way the Government runs environment programmes. They believe that political intervention is necessary for any effective climate policy to emerge.

We as a citizens organisation, believe that people's perception about climate changes should be taken into account, before planning any climate change mitigation programme and all stakeholders should be given a role to play from planning to implementation. ❑

Public Perception of Climate Change, the Precautionary Principle and Public Policy

Peter Berry

ABSTRACT

Action to address environmental issues is often driven by concerns about human health effects. In this regard, human health considerations often play a key role in decisions about whether to use the precautionary principle when there is significant scientific uncertainty surrounding an issue. Public opinion polls reveal that there is currently little understanding of the causes of climate change and its effects on human health. There is a need for greater communication to the public of the risks associated with climate change. ❑

Session B2

ASSESSING MEDIA REPRESENTATIONS OF CLIMATE CHANGE

Cycles upon Cycles: The Evolution of Media Attention to Global Climate Change
James Shanahan
Cornell University

Is Mass Media Coverage of Global Warming Culturally Bound?
A Comparison of French and American Coverage of Global Climate Change
Dominique Brossard, Jim Shanahan, and Katherine McComas
Cornell University

The Case Study of Climate Change: The Nature of Risk and the Risk of Nature
Jennifer Good
Cornell University

Media Narratives of Global Warming
Mark Meisner
State University of New York - Syracuse, College of Environmental Science and Forestry

Cycles upon Cycles: The Evolution of Media Attention to Global Climate Change

James Shanahan

This presentation presents an update of a research program on media attention to the issue of global climate change. Previous studies in the research program have established that narrative factors drive media attention to climate change issues. This study adds data from 1997-2000 to update theories on factors underlying media attention to the issue.

In the years since 1997, it has become increasingly clear to scientists that climate change is a fact that we will live with; has this certainty been matched in media coverage? Analyzing news stories from the New York Times, the Washington Post — and expanding our analysis to other important papers, both in the US and internationally, including Canada — we look at how climate change coverage has evolved in an attitude of increasing certainty about the science of the issue.

We use quantitative content analysis to assess themes in coverage, to assess predictions of consequences, to identify sources, and finally, to make interpretations about the narratives of climate change. In this study, we attempt to ascertain whether the lesson of the "master narrative" of climate change coverage from 1980-1995 has formed the basis for coverage after that period. Briefly, we have shown in the past that media distrust of climate change was a constructed phenomenon. After a period of predictions of disastrous consequences (using a "danger frame"), journalists reverted to their traditional "conflict" frame, accepting assertions that climate data rested on unproven models. By 1995, this cycle of danger/conflict had resolved itself, and media attention to climate change had dropped significantly. But since 1997, attention has resurged. In this study we ask, on what basis has the coverage resumed?

Our research project is one of the few to look at media coverage of climate change in an ongoing way; we continue to add new data to our database yearly, expanding most recently to include French data from Le Monde.

INTRODUCTION

In 1988, the national press began to pay attention to the phenomenon then known as the "greenhouse effect." From 1988 to approximately 1992, the science and consequences of global warming were a topic of frequent national discussion. But the discourse in the press petered out as attention turned to other issues (the Persian Gulf War was the main competitor). The public was left with the feeling that there were no firm conclusions in the scientific community, and that indeed global warming may have been an overhyped phenomenon (McComas & Shanahan, 1999).

Many scholars analyzed the phenomenon of this initial wave of global warming coverage. Principally they dealt with the issue of why the coverage was not sustained; that is, the major question was why the issue was covered in an almost hysterical manner that seemed destined to fizzle out. The steep drop in amount of coverage could be explained in any number of ways; a variety of theories were offered. So much was done that the global climate change issue seemed to be the archtypical laboratory for studying coverage of a scientific issue.

A lot of this literature starts with a hypothesis offered by Downs: that issues are naturally covered cyclically, especially environmental issues. Thus, issues first attract "alarmed" attention because they're new; as people get used to them, and also realize that there may be costs to solving the issue, attention fades. But there is much that is controversial about Downs' hypothesis. As McComas and Shanahan (1999) noted

> Hilgartner and Bosk (1988) see Downs' model as a "natural history" approach. They argue that rather than moving linearly from one stage to the next, social problems can exist "simultaneously" in many stages of development. The authors contend that Downs ignores the interactions between coexisting problems that help to define problems as meaningful and argue that a problem's life cycle relates less to public attention than to the problem's construction in public forums, such as in the media (Hilgartner & Bosk, 1988, 54-55). Rather than a "natural" decline in attention, institutional factors, such as "carrying capacities," competition for space, and need for sustained drama, influence attention decline (pp. 58-61). We agree with most of their assertions, although we would note that media do tend to construct problems linearly: one of the jobs of narrative is to frame issues as having beginnings, middles, and ends in a generally one-directional temporal fashion.

Other explanations looked at the "reinforcing" effect of media coverage. Trumbo (1994) dealt with "intermedia" agenda-setting relationships in news media coverage of global climate change from 1985 to 1992. He found that among the various media, the decision to cover global climate change occurred almost simultaneously. Clearly, a kind of critical mass can develop among media institutions for major issues; once that mass is surpassed, the issue will get attention across the media spectrum.. Trumbo's study shows that intermedia cooperation is necessary to frame a story as having narrative importance (also see Mazur & Lee, 1993). But as Gandy (1982) points out, the media will always rely on information providers (sometimes scientists, in this case) to provide grist for their mill.

Ungar (1992; 1995) offered another account, focused on the "social scare" that the hot summer of 1988 precipitated. Simply, Ungar (1992) argued that "real-world events" (p. 483) attracted social attention, pointing out that scientific evidence of global warming existed for quite some time before the enormous increase in attention in 1988. In other words, the fortuitous coincidence of hot weather with scientific findings was enough to draw the attention. He also argues that the cycle dies because one can't maintain the level of dramatic crisis over the environmental issue. Ungar also argued (1995) that global warming would not regain attention and concern without new "novelty and drama" (p. 450).

Trumbo (1996) offers another recent perspective on cycles of news media attention to climate change relative to Downs' hypothesis. He argues that media attention to global warming can be seen in terms of the claims of sources quoted in the coverage (see also Gandy, 1982). His content analysis showed that scientists were quoted as sources most often about the causes and problems of global warming; in comparison, politicians and special interest groups were quoted most often about judgements or remedies. He also observed a change in story emphasis: the percentage of scientists quoted in the media decreased while that of politicians and interest groups increased across the decade sampled. Trumbo points out that the transition in source dominance concurs with the problem-solving phase in Downs' cycle. Yet while Trumbo attributes the transition to scientists leaving "the debate as it heated up" (p. 281), we argued (McComas & Shanahan, 1999) that the narrative factors demanded this switch.

All these studies, and others, despite their disagreements, seemed to be in accord on one point: that the coverage did behave according to cyclical patterns identified by Downs (1972), where after a spate of alarmed coverage the issue would recede more or less into obscurity, as society had marshaled its resources to deal with the problem. Yet recent years (beginning in 1996 and especially in 1997) have seen the resurgence of a new cycle. It brings much more frequent coverage than even the peak years of the first cycle, raising the question: what motivated journalistic attention the second time around?

McComas & Shanahan (1999) had identified a narrative explanation for the ups and downs of the first cycle. They argued that the early phase of the first cycle was predicated on danger. Stories were built on primarily on predictions of impending danger: higher temperatures, flooding, droughts, desertification and other threats comprised the gist of most stories. Some examples follow:

> THE YEAR is 2035. In New York, palm trees line the Hudson River from 125th Street to the Midtown exit.
>
> Phoenix is in its third week of temperatures over 130 degrees, and the project to cover the city with air-conditioned domes is still unfinished.
>
> Holland is under water. Bangladesh has ceased to exist. Torrential rains and rising seas there have killed several million people and forced the remaining population into makeshift refugee camps on higher ground in Pakistan and India.
>
> In central Europe and the American Midwest, decades of drought have turned once fertile agricultural lands into parched deserts. Tens of millions of people continue to trek northward — the greatest mass migration in recorded history. Canada's population swells from 20 million to 200 million in less than four decades. Forest fires rage out of control over millions of acres in the Pacific Northwest, while the Mississippi River, closed to commercial traffic earlier in the century, becomes a vast earthen plain, allowing people to cross over by foot for the first time in human memory.
>
> Welcome to the Greenhouse World of the 21st century. (Jeremy Rifkin. "The Greenhouse Doomsday Scenario." July 31, 1988 *Washington Post*)
>
> Disease-carrying parasites swarming up from the tropics and soft clams disappearing from the Chesapeake Bay are among the dislocations and disturbances that scientists say are possible results of a long-term global warming trend that they agree is taking place. (P. Hilts, *The Washington Post*, December 8, 1988, A4)

These and other typical examples focused on scenarios of doom and destruction. Rightly or not, journalists bought into the worst case scenarios, sometimes offered by known doomsayers (such as Rifkin in the above example). As the first cycle progressed, however, attention eventually turned to scientific controversy. Disputes over the accuracy of forecasts, between scientists and other stakeholders, took the coverage toward the issue of uncertainty. By the end of the cycle, in the environmental backlash year of 1995, it seemed that the public reaction to global warming was now clearly one of disbelief, or at least a postponed sense of urgency.

> You get can get answers by modeling. But scientific models are notoriously subject to the tweaking of underlying assumptions. The predictions of the Intergovernmental Panel on Climate Change have already been significantly modified. In 1990 it predicted a 6-degree (F) rise by 2100. The prediction now is down to a 3 1/2-degree rise, a 40 percent drop. And there is a huge range of uncertainty: The lower-end estimate is less than 2 degrees F. (Charles Krauthammer, "Global Warming Fundamentalists; This is nuclear winter without the nukes." *Washington Post,* December 05, 1997)

McComas and Shanahan were led to conclude "from a narrative viewpoint, the switch in story line and the decrease in newspaper attention combined to suggest that a resolution was near: global climate change was being taken care of, if indeed the condition existed at all, and public attention and concern could move on to other more pressing issues". But they also concluded that the issue would inevitably return.

Any cyclical analysis of media coverage, however, will be out of date as soon as a new cycle begins. Indeed,

> global warming issues have been reopened in a number of ways. The Kyoto (Japan) Conference in December 1997 spurred some media interest in global warming. More noticeably, perhaps, the reappearance of ENSO (the El Niño Southern Oscillation) has again riveted the media's attention on climate issues. (Shanahan & McComas, 1999, p. XX)

The purpose of this paper is to analyze how the narrative has progressed since then. Building on the conclusion of the previous narrative, that science can't be trusted and that weather is fickle, this paper extends our analysis through the years 1996 and 1997, a time when global warming coverage returned with a vengeance. But with what effect?

METHODS

This paper uses the method reported in McComas & Shanahan (1999, see this paper for full details). Briefly, we used a NEXIS keyword search to collect *New York Times* and *Washington Post* articles between 1980-1997 whose primary theme was global climate change. We chose these newspapers because they are generally considered newspapers of record. All articles appearing throughout the *New York Times* and *Washington Post* and satisfying the following parameters were recorded for the content analysis: HEADLINE (GLOBAL WARMING OR CLIMATE CHANGE OR GREENHOUSE) AND GLOBAL WARMING OR CLIMATE CHANGE OR GREENHOUSE EFFECT AND DATE (IS AFT 12-31-79 AND BEF 1-1-98).[1]

The entire text of each article was examined for themes and consequences. Among the various themes were "consequences of climate change," "controversy among scientists," and "economics/costs of remedy." Each theme was coded as "not present," "present," or "outstanding focus/appearing in the lead," allowing us to track the importance of the story theme during the sample period. For example, if a story began, "Scientists report that warming caused by the build up of greenhouse gases could melt polar ice caps, according to a study reported in the journal, *Nature*," then both "consequences" and "new evidence and research" would be coded as the story's outstanding focus. If the story went on to describe how politicians reacted to the study, then "domestic politics" would be coded as a "present," though secondary, theme.

The authors and others coded articles after having conducted coder training to increase reliability. We tested intercoder reliability by double-coding a computer generated random subsample of the data set. We analyzed reliability in the assessment of themes and consequences and found, using Scott's pi as an estimate, an average intercoder reliability of .60 for themes and .79 for consequences.

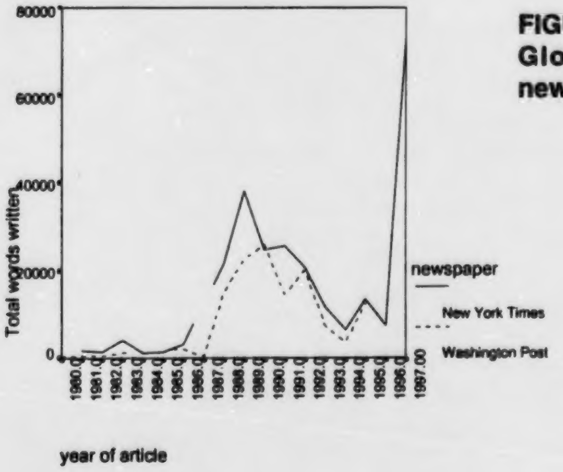


FIGURE 1.
Global warming coverage in two newspapers

Research questions

This paper focuses on the years after the first cycle. To develop the research questions, some analysis is first necessary. Figure 1 shows the amount that each newspaper in the dataset wrote about global warming in that year. The beginning of the first cycle can clearly be seen around 1987, and clearly gains strength in 1988. In the early 1990s, the cycle begins to lose strength, and definitely bottoms out in 1994. The years from 1995 to 1997 then see a resurgence, with a much higher peak in 1997 than had previously been seen. Though our dataset does not extend past 1997, we do know that attention has slacked since then, creating a clear "second cycle" of coverage.

The purpose of this paper is to examine differences between the first and second cycles. Primarily we look at differences between themes. Are the themes of the second cycle the same as those of the first? Is science as important now? Is politics or controversy more of an issue? What sources are used in each cycle? How has the second cycle built on the conclusions of the first cycle?

RESULTS

To show differences between the two cycles, we simply divided the dataset into two parts, with 1994-1995 as the split year. Because we have not yet completed the analysis of *Washington Post* data, this analysis focuses only on *The New York Times* (though past analyses have shown that the two papers tended to mimic each other in terms of content patterns; this can also be seen in Figure 1).

Figure 2 shows differences observed between the two cycles for the theme of new evidence or research. As might be expected, the first cycle focused much more on new evidence, because the first cycle, by definition, was about newly important results. However, as Figure 2 also shows, the frequency of even general scientific discussion also decreased. As Trumbo argued, there is a tendency for the scientific frame to disappear, even toward the end of the first cycle. This is very much magnified in the second cycle.

It is not surprising that science diminished in importance, even though the years have seen what everyone would agree is a massive increase in the amount of data being poured out about global climate change. Most of these data are now less interesting, and the public is probably more skeptical about them. As scientists come to agree with each other more, there is less to report. So what is replacing science as the story focus?

In our first analysis, we concluded that the first cycle ended with a focus on scientific controversy. That controversy

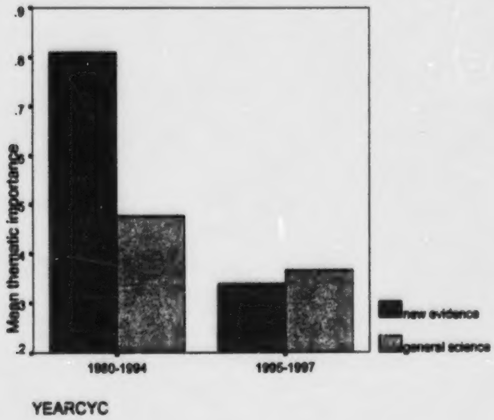


FIGURE 2.
Thematic importance of science

was resolved in favor of an attitude that science was not, nor could it ever be, perfectly clear, on issues of global climate change. Paradoxically, though, science became more certain in the meantime. Now, in the second cycle, it is fairly easy to pinpoint what are the issues of interest. First, of course, was the Kyoto conference of 1997, where international politics but especially economics takes center stage. As Figure 3 shows, these two issues increased in importance from the first cycle to the second cycle.

With this increase, journalism turned much more toward issues of how to solve global warming and other climate problems. This was motivated largely by the agenda of the Kyoto conference, but it was clear that US policy makers felt little pressure to achieve objectives that had been promised earlier. Though journalists reported these promises, and commented on possible embarrassments for Clinton administration policy, there was little sense of public demand that the issue be dealt with "now." Indeed, such a sense had been lost at the end of the earlier cycle, when the credibility of climate science had declined significantly. So, the calls for international agreements were seen more as a typical US vs. The World international relations scenario than as an important scientific issue. Even though most scientists had now agreed that the science was clear, there was surprisingly less public resolve than before, when the issue had been much less clear.

Only one other theme received increased attention and importance: the theme of "current weather." Especially toward the end of 1997, there was a lot of discussion of El Niño and the associated "weird weather" around the world (see Good, 2000 for a larger discussion of this). This provided a revisitation of what it was like in 1988, with the attendant sense of possibility of doom that will always attract news coverage. And indeed, "El Nino" began to get the same currency in everyday usage that "global warming" had gotten ten years earlier: from 1998 to 1997-98, the sense of going back to a place we had already been was palpable.

But within the second cycle, the connection to a smaller scale weather oscillation also provided a possible rationalization: because El Niño is a "regular" weather occurrence (as opposed to an anthroprogenically induced *climate* change) it became much easier to see current weather as explainable outside the boundaries of climate variation.

> ICE, HEAT, FIRE, FLOOD WEIRD WEATHER NEVER LET UP
>
> As the weird weather poured in, El Niño became the favourite scapegoat. The Pacific Ocean became the catch-all explanation for anything that didn't seem normal. (*Toronto Sun*)

The headline and citation from the *Toronto Sun* are exemplary of much media coverage, which seemed to revel in the weather's ferocity, and the fact that a name could be given to it. One can speculate that the personification of

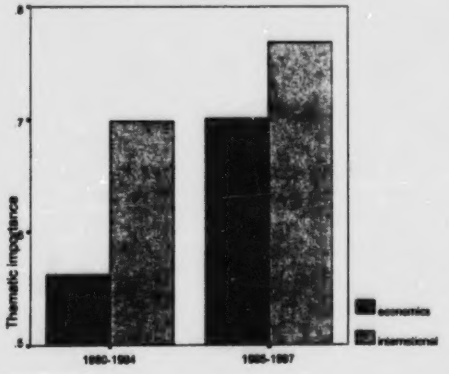


FIGURE 3.
Thematic importance of economics and international relations

a weather phenomenon did something to distract attention from the less concrete, harder-to-grasp, and more-argued- about phenomenon of global warming.

A final set of differences has to do with the sources used in the articles. Consistent with the results above, one would expect scientists to appear less frequently as sources in the second cycle. This is true; measured relative to the amount of words in each article, scientists are significantly less likely to be sources in second cycle stories (p =.011). "Policy" sources (politicians, lawmakers, etc.), were also less frequent (p = .02. Indeed, the overall number of types of sources seems to have declined in the second cycle. The only group that held steady between the two periods was economists and business leaders. In sum, while the absolute number of types of sources declined, especially for science, business and economic concerns received as much attention as they did in the previous cycle.

DISCUSSION

This analysis is preliminary. It does not include analysis for the *Washington Post* data, which is ongoing. Also, it ends with 1997, where a cycle may or may not have peaked; thus it does not include the entire second cycle. However, we may engage in some preliminary speculation.

The first cycle, as we characterized, was composed of a two part narrative: speculation about danger, followed by scientific controversy. The overall moral was the same as that in classic stories such as "Chicken Little" or the "Boy Who Cried Wolf." Strident predictions that don't come true damage credibility. Not that we hold scientists themselves responsible: after all, it was the journalists who crafted the narratives. With this moral, we see the overall significance of the coverage from 1988 to 1994: science cannot be trusted.

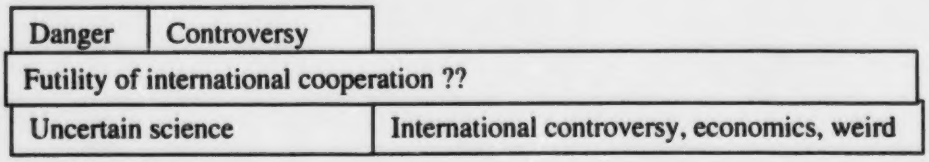
This narrative is confirmed in many other science stories. Medical advice, nutritional recommendations, and the results of countless studies are constantly being reversed as new studies emerged. As the press slavishly follows each new study, overturning sometimes strongly held beliefs, citizens can imagine that they knew best all along, or that it is worth little to pay much attention.

Will this happen with global climate change? The newer coverage shows that science is no longer the basis for interest; such interest is moving toward politics, economics, and international relations (along with variations in current weather). Such was what Downs originally predicted: all issues must eventually move toward policy resolutions. Predictably, a global issue must be resolved in the global arena.

But it must be remembered that the current narrative is premised on the conclusion from the previous narrative. Thus, with the position of science somewhat destabilized, there is greater latitude for the US to pursue policies that do not meet international goals. The entire first cycle can be seen as the basis for a new narrative with the second cycle as its conclusion. Figure 4 shows how this works:

At the first, lowest, level of the figure, we see the familiar tropes of the first cycle. Danger is followed by controversy. As argued, this results in a narrative lesson about the uncertainty of science. This moves us to the next level,

Figure 4 Narratives of global warming


Danger
Controversy
Futility of international cooperation ??
Uncertain science
International controversy, economics, weird

where uncertain science is now the premise, followed by the next trope, which has to do with international politics, economics, and a de-scienced issue of climate change. How do these tropes go together; what outcome do they reveal?

The answer is unclear, because we don't know how the second cycle concludes. Analysis will show how the activities of the international tribunals were finally hashed out in the press. One very strong possibility is that the international climate change process will eventually be treated as a series of meetings with targets that the US never observes; as with much international politics, UN style debate and agreement setting can often be seen as futile. Thus, uncertain science, seized upon by unreasonable international partners, and carried out in an atmosphere where goals are never met, may teach that global climate change is simply an issue that *can't* be changed, or shouldn't.

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FOOTNOTES

[1] Our first analysis (McComas & Shanahan, 1999) only extended to 1995. This analysis completes the dataset

Is Mass Media Coverage of Global Warming Culturally Bound? A Comparison of French and American Coverage of Global Climate Change

Dominique Brossard, Jim Shanahan, and Katherine McComas

Analysis of media coverage of international environmental issues such as global climate change have been performed primarily at the national level; most analysis has focused on coverage in US newspapers. In some ways, theories of media coverage about global climate change fail to convey the "global" or international aspect of the issue. In order to understand how a country's journalistic and scientific cultures influence media coverage of global climate change, we performed for this study a comparative content analysis of 312 stories on global climate change in an American newspaper (The New York Times) and of 212 stories on the same topic in a French newspaper (Le Monde) for the period 1987-1997. We compared the frequencies of coverage, the nature of the themes emphasized in the articles, the sources of information and the predicted consequences of global warming as presented by the articles.

The preliminary results show that American and French coverages differ significantly in terms of cyclical patterns as well as in terms of the nature of the themes emphasized in the article. While The New York Times' coverage followed an issue-attention cycle to environmental issues as theorized by Downs in 1972 (Shanahan 1999), Le Monde's attention cycle was more specifically tied to international political events. A statistically significant difference between the themes developed in the American and French articles also exists, with The New York Times giving more emphasis to scientific controversies and Le Monde stressing international political issues.

Our discussion offers an explanation linking cultural characteristics of the French and American printed media to the nature of the coverage, and emphasizes how a mutual understanding of French and American coverage could be beneficial for an improved coverage of global climate change.

INTRODUCTION

In the past decade, many studies have analyzed media coverage of global climate change, or global warming (Mazur, 1998; McComas & Shanahan, 1999; Nissani, 1999; Shanahan, et al. 1998; Trumbo, 1996, among other recent studies). However, little attention has been paid to other countries' media coverage of global warming or other international environmental issues (for some exceptions see Bell, 1994; Gooch, 1995; Reis, 1999). Also, although a number of studies have focused on cross-national analysis of risk communication (Dunwoody and Peters, 1992; Rowe et al. 2000), cross-cultural comparison of global warming media coverage has yet to be done. We argue that such a comparison is essential for a broader understanding of the mechanisms underlying media coverage of global warming. On the one hand global climate change is an international environmental issue that concerns every country in the world. Science is an international enterprise in which norms and values are often seen as crossing national barriers (Dunwoody and Peter, 1992). On the other hand, journalistic practices may vary among countries where political agendas may differ. Attitudes toward science and the environment may be drastically different. It can therefore be wondered to what extent the "global" component of the issue of global climate change will lead to coverage characteristics that transcend national boundaries.

Based on a quantitative content analysis, we show in this study that national cultural characteristics can be a major factor influencing media coverage of global climate change. Although it has been argued that trends in risk communication can be found at the international level (at least for western developed countries, see Dunwoody and Peters, 1992), we will show that this is not the case for an environmental issue such as global warming when comparing the coverage in France and in United States, two western, developed countries with cultures dissimilar enough to potentially have an impact on media coverage of global warming.

We compare in this study the coverage of global warming by the French newspaper *Le Monde* and the American newspaper *The New York Times* for the period 1987-1997. These two daily newspapers are similar in terms of audience characteristics and political stand, and are both newspapers "of record" in their country of origin. The present study builds on McComas & Shanahan's (1999) research on media coverage of global warming and uses their exhaustive database of *New York Times* articles on global warming. Our comparison will have two focuses: media attention to the issue, and the nature of the coverage.

Media Attention to Global Warming

The cyclical nature of media attention to environmental issues has been widely investigated. The "issue-attention cycle" proposed by Downs (1972) offers a theoretical framework for such a cycle that is widely accepted in environmental communication. According to Downs (1972), public attention to issues such as the environment go through up and downs and passes through five phases: (1) a pre-problem stage; (2) a period of alarmed discovery of the problem, and of eagerness to rapidly solve it; (3) the realization of the costs associated to solving the problem; (4) a decline in public interest; and (5) a post-problem phase, characterized by the settlement of public attention, but that can also see sporadic returns of interest. According to Downs (1972), the characteristics inherent to environmental issues will foster the cyclical up and down of the attention. Particularly, Downs argued that issues may not be particularly exciting, or if they are perceived as such, it may fade over time.

American media coverage of a large number of environmental issues has shown the cyclical pattern that Downs has proposed (McComas & Shanahan, 1999). Quantitative ups and downs of media attention to global climate change have been well documented (Mazur & Lee, 1993; Trumbo, 1994, 1996; Ungar, 1992; McComas & Shanahan, 1999). However, Downs' media-attention cycle has also been criticized; many contemporary scholars go beyond the hypothesis, attempting to propose other explanations for such a cyclical pattern (see among others Hilgartner and Bosk, 1988; McComas & Shanahan, 1999; Shanahan, Trumbo and Good, 1998; Trumbo, 1994, 1996; Ungar, 1992, 1995).

In the present study, we will step back and test Downs' hypothesis in a broader context. No research has yet examined if the cyclical pattern of media attention to global warming is linked to the issue itself, or whether it may be a peculiar characteristic of American coverage of environmental issues. As we explained earlier, Downs (1972) argued that environmental issues intrinsically possess qualities that cause the public to eventually turn its attention to more interesting problems (McComas & Shanahan, 1999). If this is the case, media coverage of the issue of global warming in other countries should show a cyclical pattern similar to the American one. The first part of our study will therefore be exploratory, by attempting to answer the following research question:

- ***Research question #1: Does French media coverage of global warming show a cyclical pattern comparable to the American pattern?***

The second part of our study will compare the nature of American and French coverage of global warming. We will discuss two cultural aspects that we believe can strongly impact the nature of media coverage: what makes "exciting" news and what is expected of the journalist in each culture.

Nature of the Coverage: Constructing Exciting News

It has often been claimed that information needs to be novel or significant in order to make the news. The information should also be exciting enough to retain public attention. This is a journalistic reality that is valid in United States as well as in France, at least for science-related issues (Fayard 1988). According to Downs (1972), environmental issues are in essence not particularly exciting. McComas & Shanahan (1999, p. 35) have argued, however, that there is "less pre-given excitement … in an issue than Downs assumes: It is a matter of social, institutional, and communicational choices to construct issues in exciting ways." In their study, these authors showed how American media actively constructed narratives about global warming in order to maintain public interest. Following McComas & Shanahan (1999), we take a constructionist approach and arguing that environmental issues are not merely exciting, but are constructed as exciting. However, we add a cultural component: what is considered exciting in a cultural context may not have the same significance in another. This may imply that even if issues are constructed as "exciting" in two cultures in order to make the news, the "excitement" component may be completely different. In the following section, we will discuss the concept of "exciting news" in the context of *The New York Times* and *Le Monde*.

During the last decade in United States, mass media have been more and more interested in scientific events that gave the possibility of presenting spectacular, sensational news (Friedman, 1986). Scientific "controversies" in particular have been particularly interesting. According to Lewenstein (1994), such coverage has been shaped by media's need to present stories that emphasized conflict. As stated by Priest (1999, p. 97) the science "whose truth has not been settled by consensus, either public or scientific… is the type of science that makes the news." In other words, conflict makes exciting news. It is therefore probable that scientific controversies will tend to be an important theme in American global warming coverage. Also, as Downs (1972) suggested for the second phase of his media-attention cycle, concern over the consequences of the environmental problem (i.e. fear-generating stories) will certainly give an exciting component to the news. McComas & Shanahan (1999) showed how *The New York Times* constructed global warming as exciting news through narratives that evolve to maintain public interest. Stories' narratives emphasized consequences of global warming in a first phase of the attention-cycle (which they called the upsurge of media coverage), and controversies among scientists in a second phase (referred as the maintenance phase of media coverage).

Would *Le Monde* also use the potential consequences of global warming and the controversies existing among scientists to construct the issue as exciting? *Le Monde* is a newspaper that traditionally has focused on political news (as have the other national dailies in France) (Charon, 1995). French journalism is a journalism of "opinion" rather than of "information" (Kuhn, 1995). As opposed to American "investigating journalism" based on the unveiling of facts, French journalistic style has been described as indirect, allusions and story-telling being used to convey a message (Lamizet, 1996). In this context, presenting "consequences of global warming" may not seem a particularly "exciting" angle to adopt by a French journalist, since it would merely be translated in a list of "facts" that do not easily lead to an opinionated argument. It could be assumed that "controversies among scientists" may be considered more "exciting" since by essence more controversial. However, *Le Monde* has by tradition favored political issues over scientific issues. Since global warming is the first international environmental issue that has to be resolved at the international level where the European Community (and by extension France) has a crucial role to play, the international political aspects of the issue may provide the "exciting" component necessary to make news. We will therefore test the following hypothesis:

> H1: The New York Times emphasizes more the controversies among scientists on the subject of global warming than Le Monde does.
> H2: The New York Times emphasizes more the negative consequences of global warming than Le Monde does.
> H3: Le Monde emphasizes more issues linked to international relations than The New York Times does.

Nature of the Coverage: "Objectivity" Vs. "Opinion" In Journalistic Reporting

We explained earlier that French journalism is a journalism of opinion rather than of information (Kuhn, 1995). Also, a tradition of political and social commitment ("engagement") of the press is well established in France (Lamizet, 1996). While *Le Monde* has no organizational connection with a political party, it is however committed to socially progressive goals, which have been described by its founder, Hubert Beuve-Méry, as "social liberalism or liberal socialism" (Kuhn, 1995). This may be seen in *Le Monde*'s stories as a tendency to limit to some extent the number of viewpoints at odds with the newspaper's that may be expressed on an issue such as global warming.

On the other hand, "the ritual of journalistic objectivity" (Tuchman (1972) as cited in Stocking, 1999, 33) or "balance perspective" (Ryan, 1991) is particularly important for American journalists. Although there is a debate going on within the environmental journalism community over objectivity vs. advocacy in reporting (LaMay, 1991), the majority of mainstream journalists are expected to seek opinions of all sides [It has been noted that the "ritual of objectivity" may even lead science journalists to give equal weight to majority and fringe scientists, or to scientists and nonscientists in science reporting (Stocking, 1999)].

This discussion leads us to the following hypothesis:

> Hypothesis 4: The New York Times presents more viewpoints on the issue of global warming than Le Monde does.

METHOD

Sample

The analysis focuses on articles on global warming published in *The New York Times* and *Le Monde* during the period of 1987-1997. *The New York Times* was chosen because it is considered a newspaper of record, and because an exhaustive database of articles on global warming had been collected for prior research (see McComas & Shanahan, 1999). *Le Monde* was chosen because it is a newspaper of record in France; it is similar to *The New York Times* in terms of readership and political stand. Two different procedures were followed to collect *The New York Times* and *Le Monde* samples.

a)* The New York Times' *Sample

We used in this study an updated version of the database of *The New York Times* articles on global warming built by McComas & Shanahan (1999) for the period 1987-1995 (n_1=206). Using the same procedure (see McComas & Shanahan, 1999, for details), a Lexis-Nexis search was run to update the database for the period 1995-1997. All articles appearing through *The New York Times* and satisfying the following parameters were recorded for the content analysis: headline (global warming or climate change or greenhouse) and global warming or climate change or greenhouse effect and date (is after 12-31-96 and before 1-1-98). This search collected a workable sample of stories (n_2=117) that were published during the 2 years period. During the analysis, 1 article that was not about global warming was discarded. We therefore obtained a sample of 322 articles for *The New York Times* for the period 1987-1997.

b)* Le Monde *Sample

In order to be as consistent as possible with *The New York Times*' procedure, an initial search was performed on Lexis-Nexis with the same parameters (i.e. headline and text search). This led to a very small sample of articles on global warming. It was observed that *Le Monde*'s headlines often are not clearly representative of the content of the articles, and that French journalists use a variety of terms to designate global warming (see Appendix 1). A second search that included all these terms and that did not use the headline search was performed. This search collected a sample of 187 articles.

Since *Le Monde*'s articles published before 1990 were not available on Lexis-Nexis, we used *Le Monde*'s archives (*Le Monde*, 2000) and performed a search based on the same terms than used before (see Appendix 1). We obtained a usable sample of 21 articles, and therefore a total sample of 208 *Le Monde*'s articles for the period 1987-1997.

Measures

a) Coding Instrument

The study used the coding instrument developed and tested by McComas and Shanahan (1999), (see Appendix 2). The text of each article was examined for themes (each theme was coded as "not present", "present", or "Outstanding focus/appearing in the lead."), predicted consequences of global warming (when given, specific measurements for the change were recorded), and sources cited (this section of the instrument was updated in order to fit French context). For some of the analysis, themes were recoded in order to have two possible responses: present or absent.

b) Reliability of Measurement

Intercoder reliability was tested by McComas and Shanahan (1999) by doubling-coding a computer generated random subsample (n=47 or 13%) of the data set. Using Scott's pi's, an average intercoder reliability of .60 was found for the assessment of themes, and of .79 for consequences.

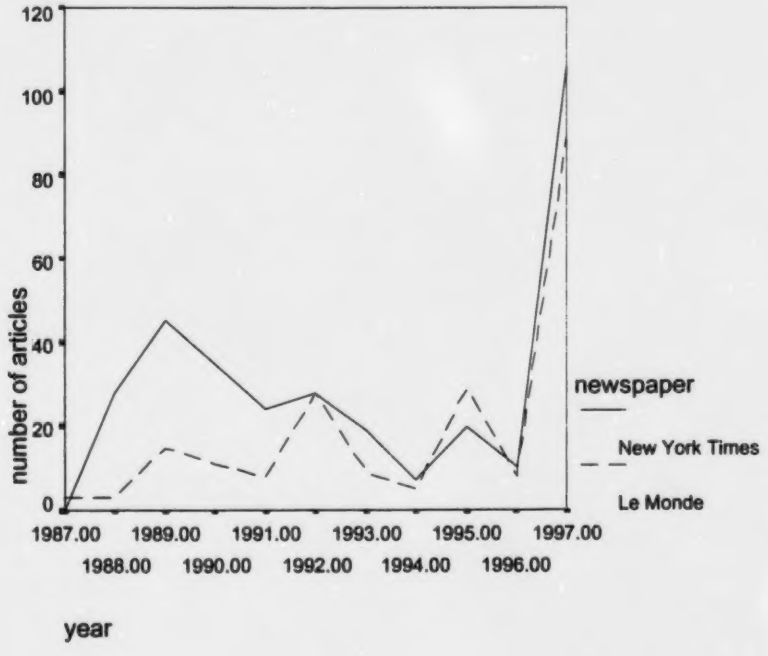
RESULTS AND DISCUSSION

We wanted to find out if the cyclical pattern of American media attention to environmental issues would be observed in the French context (Research Question #1). Figure 1 shows *New York Times'* and *Le Monde's* attention to the issue of global warming for the period 1987-1997. Media attention is measured in this case by the total number of articles published a given year.

Although a clear pattern can be observed for *The New York Times* - media attention to global warming reaches a peak in the late 1980s and falls afterwards as documented in McComas & Shanahan (1999)- no such pattern is identifiable for *Le Monde*. French media attention to global warming does present quantitative ups and downs, with attention raising in the following years: 1989 (La Hay Conference); 1992 (Rio Conference); 1995 (Berlin Conference); 1997 (Kyoto Conference). Obviously, international meetings seem to be driving media attention in the French context. This pattern is also observed when the total number of words written each year is used as a measure of media attention.

Downs' (1972) media-attention cycle therefore may be specific to American coverage of an environmental issue. It could be argued that the environmental issue itself may be perceived differently by different cultures; whether

FIGURE 1: Number of Articles on Global Warming in *Le Monde* and *The New York* Times Between 1987 and 1997



issues have intrinsic characteristics (as proposed by Downs) seem to depend upon cultural context, unsurprisingly. For example, the environmental problem may very well be perceived differently by different audiences within the culture (as suggested by Downs (1972)) but this quality may not impact the level of curiosity of the readers. While some research has examined public perceptions of global warming at the international level (e.g. Bord, 1998), no research has examined public curiosity for the issue in a cross-cultural setting. A qualitative approach (such as focus groups, would certainly help understand what motivates such a curiosity.

Our comparative analysis of the nature of the coverage in France in the United States can help to some extent document these mechanisms.

Nature of the Coverage

Figure 3 presents the mean responses for the themes of interest in *The New York Times* and *le Monde* for the period 1987-1997.

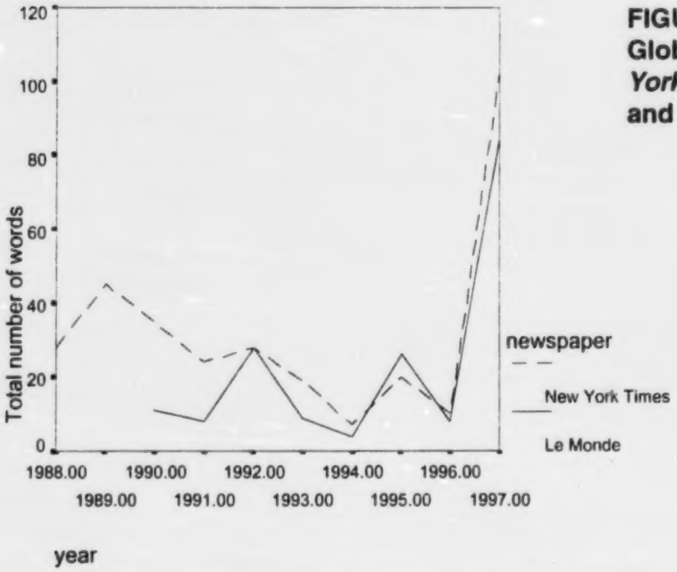


FIGURE 2: Total Number of Words on Global Warming published in *The New York Times* and *Le Monde* between 1987 and 1997

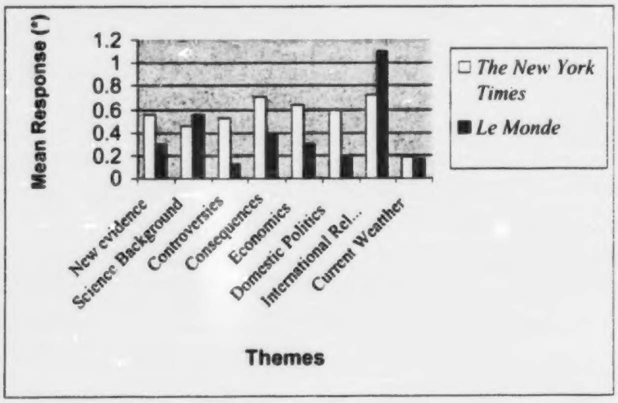


FIGURE 3: Mean response by Theme for *The New York Times* and *Le Monde*

Current weather was the least mentioned theme in the two newspapers. Interesting differences seemed to be present for most of the other themes. The theme "international relations" was on average more present in *Le Monde* than in *The New York Times*; the themes "domestics politics," "controversies among scientists," "consequences of global warming" were on average more present in *The New York Times* than in *Le Monde*. All these differences were statistically significant.

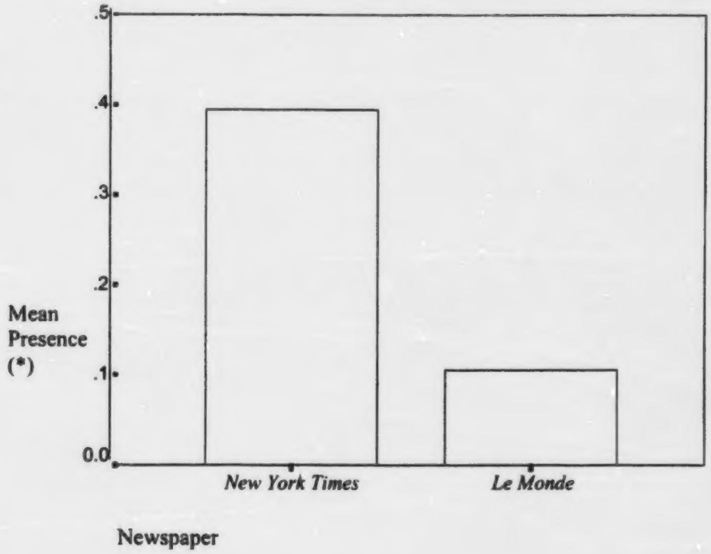
We hypothesized that, according to the American journalists' tendency to find conflicts exciting, *The New York Times* would give more emphasis to "controversies among scientists" than *Le Monde* would.

The data supported our hypothesis, the theme "scientific controversies" appeared significantly more in *The New York Times* than in *Le Monde* (t=.587; df=528; p<0.001). We suggested earlier that the notion of "exciting news" may be highly culturally charged which may explain such a difference in the nature of coverage. However, a complementary explanation can be proposed. Although the theme "scientific controversies" was less present in *Le Monde*, science around global warming was presented as uncertain in 30% of Le *Monde's* articles (the theme "uncertainty" was not coded *for The New York Times* at this point, but we can speculate that it would not have been a major theme in the stories). Scientific uncertainty can no doubt exist without controversy, science being by definition uncertain. Global warming (which at some point generated scientific consensus even if uncertainty remained in terms of the negative consequences of global warming), is a good example of this. Discussing the state of the global warming issue after 1995, Rogers (1999, 185) explained:

> "Although a consensus exists among a majority of climate scientists that global warming is occurring and that human activities are playing a role, vocal dissenting scientists highlight … uncertainties in public arenas and are regularly included in media coverage of the topic."

Rogers (1999) was interested in understanding how audiences made sense of "uncertain science" when they encountered it in the media. Rogers therefore presented *Washington Post* stories on global warming (focusing on the Intergovernmental Panel on Climate Change (IPCC) report in the fall 1995), to focus groups participants. The conclusions of the focus groups were striking: even when scientific consensus existed on the issue, participants

FIGURE 4

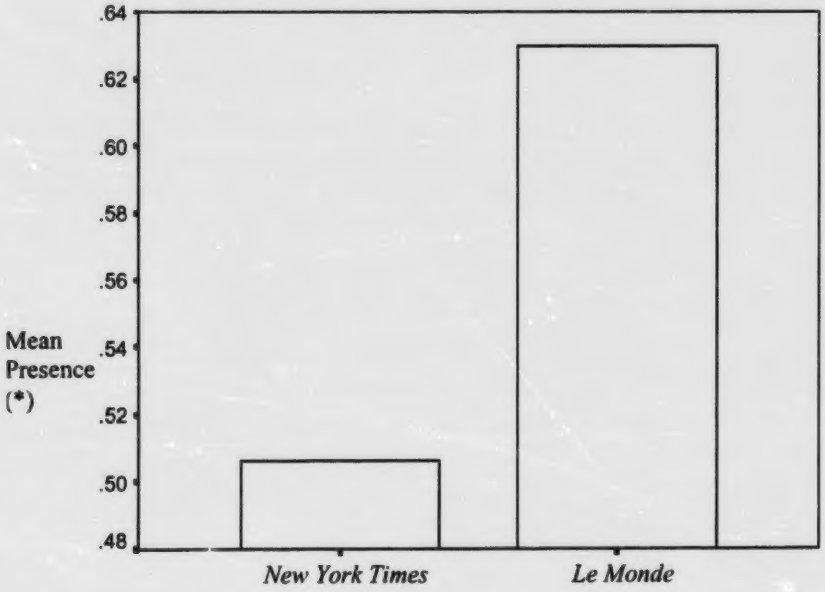


mentioned that they were aware that disagreements about global warming existed within the scientific community and were therefore stressing the "controversy" component of the stories. American journalists were hence mixing two concepts: the concept of uncertainty that can remain although a scientific consensus exists, and the concept of controversy which implies that scientists reject or dismiss others findings. This may explain why the theme "scientific controversies" was stressed to such an extent in *The New York Times stories.* On the other hand, French coverage tended to emphasize the notion of uncertainty without relying on a framing focusing on controversies. The French tendency to present science as a unified body of knowledge in the media may have in part its roots in the history of science in France (until 1968, science was an authority that was rarely questioned (Fayard, 1988)). Further research should therefore explore more in depth how the theme "scientific uncertainty" appears in American coverage of global warming, with a typology that clearly differentiates "controversy" from "uncertainty."

The data also supported our second hypothesis, which predicted that *The New York Times* would give more emphasis to the theme "consequences of global warming" than *Le Monde* would (t=5.191; df=528; p=0.000). We proposed that differences in journalistic cultures between United States and France may account for such differences. A complementary explanation, also linked to cultural aspects, can also be offered. Consequences of global warming are to some extent the results of advances in science and technology that have led to specific economic choices in industrialized countries. A recent comparative analysis of public perceptions of science and technology in Europe and United States has shown that while American are generally optimistic and not concerned about science and technology's negative consequences, Europeans characteristically hold moderately high levels of reservations about such potential negative consequences (Miller et al., 1997)[1]. In this context, negative consequences should promote a stronger interest within the American public (journalists and public at large) than in the French audience, which is pessimistic by nature. In summary, not only does journalistic culture impact coverage, but also public perceptions of science and technology.

Our data supported our third hypothesis, proposing that the theme "international relations" would be more present in *Le Monde* than in *The New York Times.*

FIGURE 5



French journalism being by tradition "opinion-based", we argued that the *Le Monde* audience would find more appealing news related to International Relations issues, which would leave more room for argumentation and point of views than stories on consequences of global warming. Lamizet (1996) has also explained that French media has traditionally supported French strong social-cultural identity, a characteristic that has its origin in France's historically strong sense of social cohesion. This feature may be seen in *Le Monde* stories as a general support for France's positions on the international political scene, and by extension for the European Community, a relatively new political power in the international arena. Anthropological approaches to media studies have investigated how media participate in the construction of identities and power relations (Dickey, 1997). We argue that French media were using global warming as a tool to help strengthen the European Community identity as a political power. An excerpt of a Le *Monde*'s article published on December 12, 1997 at the end of the Kyoto Conference illustrates this process, while a *New York Times* excerpt on the same day shows how different its narrative was at that point in time.

It seems therefore that *Le Monde* did after all use conflict as a narrative tool. However, while *The New York Times* emphasized conflicts between scientists (or conflicts between politicians or between politicians and businesses as in the excerpt), *Le Monde* focused on the conflict between Unites States (the "bad guy") and the European Community (the "good guys") stressed the opposition between the European Community (the "good guys").

TABLE 1: Excerpts of *Le Monde* and *The New York Times* articles published at the end of Kyoto Conference.

*Le Monde**	*The New York Times***
The European Union kept on pressuring the United States to have them agree to reduce their emissions, as was expected from the biggest polluters… On Thursday, European delegations were extremely satisfied of their success in making the mammouth move and for having discovered the political force that the European Community now represents on the international scene, when it talks with an unified voice.[2]	There are two salient facts about Wednesday's agreement on global warming in Kyoto. The first is that it could lead to an environmental undertaking of historic scale. If the industrialized countries carry out in practice what they promised on paper, making sustained cuts in the use of fossil fuels, they will forever alter the way the world produces and consumes energy. The second fact is that Kyoto was merely the beginning of what is sure to be a brutal battle. Winning Senate approval means defeating the treaty's well-financed opponents in business and labor, and that in turn will require an extraordinary level of Presidential energy.

* "Effet de serre; accord en vue à Kyoto sous la pression des Européens" (1997, December 11). *Le Monde*, page Une

** "The coming battle over Kyoto" (1997, December 12). *The New York Times*, A34.

In order to assess if this use of USA-EC conflict was widespread in the French coverage, we looked at the frequency of articles that mentioned or used simultaneously as a source the White House and the European Community Presidency or delegations. The simultaneous presence of both these sources may indicate that they are opposed and contrasted in the articles. About 19 % of the articles presented both sources simultaneously, which suggests that the USA and EC were important protagonists in the stories. Unfortunately, the coding of *The New York Times* did not measure if the American coverage used the EC administration as a source, therefore limiting the comparison. However, information about other sources was available which leads to the testing of our fourth hypothesis.

In order to test our fourth hypothesis, which stated that *The New York Times* would present more viewpoints on global warming than *Le Monde* would, we looked at the frequencies of quoting or citing different sources in the articles. No statistically significant difference could be found between *The New York Times*' and *Le Monde*'s uses of academic researchers or scientists as sources (Chisquare=3.64; df=1; p>0.05), and of non US sponsored research sources such as the IPCC (Chisquare=2.967, df=1, p>0.05). However, statistically significant differences were obtained for business and industry group sources (chisquare=10.487, df=1, p=0.001), which supports our fourth hypothesis. *The New York Times* cited business and industry group sources in 29% of the articles, while *Le Monde* did in 9.6%. Industry viewpoints on the issue of global warming (which tend to emphasized the potential negative consequences of a rapid reduction of the level of greenhouse emissions), may have been at odds with *Le Monde*'s viewpoint. A number of *Le Monde*'s stories stressed the limits of economic growth, the necessity of balancing economic growth with environmental protection, and the need for humans to protect the balance of nature. In other words, *Le Monde*'s reporters were subscribing to some extent to the new environmental paradigm proposed by Dunlap and Van Liere in 1978, which would be in accordance to *Le Monde*'s socially progressive goals (as we mentioned before, *Le Monde*'s founder describe its goals as "social liberalism or liberal socialism" (Kuhn, 1995)). At first glance, the extensive use of business sources by *The New York Times* could suggest that this newspaper was promoting consumerism and materialism, both components of the dominant social paradigm (Dulap & Van Liere, 1984), a feature of American media that has been pointed out by Dunlap and Van Liere (1984) and Shanahan (1996). However, a look at the use of other sources seems to dismiss this assumption. While *Le Monde* citations of Greenpeace appeared in 3.4% of the stories (1.9% for *The New York Times*), other environmental groups were present only in 5.7% of *Le Monde* articles while cited in 19% of *The New York Times* articles. The use of business sources by *The New York Times* may therefore be more due to the "balanced-perspective" reporting, than to a subscription to the dominant social paradigm. Although this conclusion should be supported by a more in-depth analysis, we can however conclude that journalistic culture had a clear impact on the nature of the reporting.

CONCLUSION

The results of this study document that culture can be a major influence on the coverage of an international environmental issue such as global warming, all of our hypothesis being supported by our data. First, we showed that Downs' (1972) "media-attention cycle" was specific to American coverage of an international environmental issue such as global warming and was not a pattern that was apparent in French coverage. Second, elements of journalistic culture (such "opinion" versus "objectivity" in reporting) had a clear impact on the nature of the coverage, influencing the themes been covered and the sources cited. Finally, we argued that stories about global warming used different protagonists in France and United States. France focused on conflicts between United States and Europe in order to build an European identity as an international political power. United States emphasized conflicts between scientists, and between politicians and focused on domestic politics. International negotiators should be aware of such differences of coverage and of their potential impact on public perceptions. More generally speaking, cultural issues may be critical for the success of international agreements on global warming.

We therefore believe that cross-cultural comparisons of media coverage of international environmental issue are necessary and should be undertaken. Our research has yield interesting results. More in-depth content analysis of media coverage would help document in more details how media actively culturally construct environmental issues. ☐

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FOOTNOTES

[1] Such a tendency can be observed in current debates about genetically modified organisms

[2] L'Union Européenne …n'a pas cessé de mettre la pression sur les Américains pour que ceux-ci, en tant que plus gros pollueurs, acceptent de réduire leurs émissions… L'ensemble des délégations européennes ne cachaient pas leur satisfaction, jeudi, d'avoir fait bouger le mammouth et d'avoir découvert la force politique que l'Union représente désormais sur la scène intenationale, lorsqu'elle parle d'une seule voix.

APPENDIX

Terms Used for the Search of *Le Monde*'s Articles on Global warming

- Réchauffement global
- Réchauffement climatique
- Réchauffement du climat
- Réchauffement de la planète
- Réchauffement planétaire
- Surchauffe planétaire
- Variation climatique
- Variation du climat
- Changement climatique
- Changement du climat
- Effet de serre.

The Case Study of Climate Change: The Nature of Risk and the Risk of Nature

Jennifer Good

It is possible to think of climate change as the quintessential modern day risk. With its complex, large-scale and uncertain science, Climate change pits the essence of industrial society — the burning of fossil fuels — against what is potentially the largest scale "natural phenomenon" — the climate.

As a modern day risk, climate change is far removed from the historic roots of environmental risks. In an evolutionary sense, we are accustomed to immediate cause and effect risks. In order to develop a communication strategy for this new kind of risk, this paper will: explore the current thinking around the science of climate change, look at how and what people currently learn about the environment and climate change via the media, explore climate change as a risk topic and, finally, propose a communication strategy.

INTRODUCTION

The nature of risk, and the risk of nature, have changed. For much of human history, the risks that occupied people were immediate and brutal: wild animals, disease, exposure. And nature was both the essence of life and the source of these unpredictable, not to mention undesirable, risks. Today, as Renn et al. point out, "Advances[1] in science and technology have enabled societies to accelerate the speed of technological change, to extend the scope and magnitude of human interventions into nature, and to affect individual lifestyles and social structures." Many, if not most, of the risks that are encountered in modern industrial societies are no longer immediate or even brutal (at least not in the same sense as the immediacy and brutality of early risks). And nature has become essentially a backdrop for our lives and these "modern risks."

Climate change proposes something that is a far removed as risks can be from those early risks. The science is hugely complex, and, perhaps, essentially unknowable. The timelines are massive. The implications global. And it is this complexity, scale and "novelty" that makes climate change a fascinating risk communication subject.

THE SCIENCE OF CLIMATE CHANGE

As far as we know, earth is a unique experiment. Unlike every other planet that we have come across, earth is a miraculous combination of gases and organic materials that allow for life to exist. One of the essential features of earth is a carbon dioxide "blanket" that absorbs the sun's heat as it radiates off the earth. This blanket is the "greenhouse effect." Without this blanket, the earth would be too cold to support life.

There is no question but that this greenhouse effect exists (Wilkins (1993), calls it "arguably the best accepted theory in climatology"). The question, however, is whether the huge increase in carbon dioxide that the industrial revolution wrought has increased the "efficiency" of this blanket and set the earth on a warming trend. Is the earth warming in response to human activity? The United Nations Environment Program and the World Meteorological Organization established the Intergovernmental Panel on Climate Change (IPCC) to answer this question. According to the IPCC, "the Earth will warm 2 to 6 degrees Fahrenheit by the year 2100, with a best estimate of about 4 degrees Fahrenheit." (Environmental Protection Agency, 2000) Exactly how this warming will affect the climate and therefore weather patterns — i.e. what will happen where, when, how much — is not known, may never be known, but the IPCC has concluded that there is a "discernable human influence" on the climate (EPA, 2000). The IPCC has also concluded that "there is enough evidence to warrant a sensible approach toward minimizing what could become our biggest challenge in the twenty-first century" (EPA, 2000).

This paper, therefore, accepts the IPCC's conclusion that a change in the climate – of some sort – is taking place as a result of human activity. And, this paper will eventually explore what this "sensible approach" to addressing climate change could look like, but for now, a few words on what some of the implications of climate change might be.

It is theorized that warming global temperatures would bring a greater number of heat waves and heat-related deaths; the spread of what we now consider to be "tropical diseases"; an increase in both floods and droughts; increase in glacial melt and sea level rise; increase in extreme weather events (EPA, 2000).

But there are certainly scientists who question such conclusions. The skepticism falls into the following categories:

1. The earth has always had climatic cycles.
2. Urban (i.e. hot) centers have developed around temperature monitoring stations/satellite monitoring shows a cooling trend.
3. The computer climate models are extremely complex and sometimes show that the earth will actually cool and/or that other changes wrought by increased carbon dioxide (i.e. increased plant growth) will compensate (EPA, 2000).

And while the majority of the world's climate scientists, as represented by the IPCC, refute the skeptics, the reality is that ultimately there is nothing conclusive. The interplay of human activity and climate is just too complex and, as has been pointed out above, the most we will probably ever be able to offer is a best guess.

One of the questions that this paper explores, therefore, is the implication of a risk (which is by definition unsure) on this scale. Certainly the world around us is filled with risks but apart from the risk of nuclear war, it could be claimed that the risk of climate change is largest scale risk that we face today[2]. This issue of scale will be revisited throughout the paper.

THE COMMUNICATION OF THE ENVIRONMENT

Perhaps the key distinguishing characteristic of "modern humans" from our earlier form is how we gain knowledge about the world around us. Early humanoids learned from physical experiencing. Prior to mediated communication, it could not be otherwise. But with the advent of mediated communication — commencing with language and culminating, for now, with computers — it became possible to learn without directly experiencing what it is that you are learning about. And I would propose that no aspect of our lives has been more affected by this shift than how we come to understand the environment. For much of human history we lived intimately within the environment. Now, certainly for Americans (and the industrialized world in general), we live, essentially, isolated from the environment. Or do we?

The reality is, of course, that we are intimately integrated with the environment and depend on it to survive. Our daily lives, and society's priorities, however, can remove us experientially from the environment. The claim could be made that we still fundamentally interact with the environment — breathing the air, drinking the water, eating the foods — but this interaction tends to exist unconsciously. Unconsciously unless the degradation of the earth becomes so obvious that we are forced to be conscious. In general, however, we come to learn about the environment, and the risks associated with it, not through our interaction but via the information source that tells us about a myriad of aspects of our lives that we do not experience directly: The media.

Media dependency theory was born of this notion that we come to "know" people, issues and realities that we have not directly experienced or about which we are unable to directly communicate with those around us. "Because of their social differentiation, people in urban-industrial societies have *fewer* effective word-of-mouth channels based on deeply-established networks of social ties...Therefore, people in urban-industrial societies become *dependent* on mass communications for information needed to make many kinds of decisions" (DeFleur & Dennis, 1998).[3]

So, what does the media tell us, and what do we learn about, the environment?

Content analyses of environmental news coverage (Murch, 1971; Funkhouser, 1973; Greenberg, et al., 1989; Stocking & Leonard, 1990; Daley & OnNeill, 1991; Hester & Gonzenbach, 1995) have shown an increase in environmental news reporting over the last thirty or so years and brought about critiques of how news — in its attempt to gain audience share and sell advertising — has sensationalized environmental stories and misrepresented environmental risks (Hester & Gozenbach, 1995).

In content analysis of prime-time non-news programming (Shanahan & McComas, 1997) environmental issues are shown to have a low profile. "[T]his analysis highlights that nature themes are not considered important in television programs which explore the human-centered themes which dominate [television] programming" (Shanahan & McComas, 1997). And, unlike environmental news stories, nature as a theme in prime time programming has declined over the years and even when attention is paid, it is sporadic.

When the environment is present in prime-time programming, it is associated with "issues" (i.e. politics, religion). As Shanahan and McComas point out, "The fact that television programs apparently make a very distinct separation between issues and lifestyles is of great significance for the environment, especially if viewers make a similar separation in their own minds" (Shanahan & McComas, 1997).

Of course, what is going on in the minds of mass media consumers is the other piece of the equation. Early media exposure and environmental attitude research (Ostman & Parker, 1987; Novic & Sandman, 1974) showed a negative relationship between mass media exposure and "environmentalism" (i.e. positive attitudes about the importance of the environment).

Shanahan, et al. (1997) explored this phenomenon from the perspective of cultivation ("Cultivation is concerned with the long-term, cumulative contribution of consistent and largely inescapable [mass mediated – usually television] message patterns" Shanahan, et al., 1997) and found that the relationship between media exposure and environmental attitudes is complex. While there was certainly evidence to support the notion that heavy viewers of television are less knowledgeable about environmental issues, there was also evidence that heavy viewers were distrustful of science and technology which the researchers had hypothesized would be an indicator of environmentalism.

Shanahan concluded that "environmental attitudes are not only personal constructs, but are influenced by very important social institutional forces. ...environmentalism is a complex phenomenon, and media institutions do not exert complete control over these issues in unidimensional ways" (Shanahan et al. 1997).

Another mass media perspective, that of agenda setting (the theory, first developed by McCombs and Shaw in 1972, that the media do not tell us what to think but rather what to think about), can provide an additional perspective on how people process mediated environmental messages. Environmental issues were initially used in agenda setting research because it was felt that they were "unobtrusive" issues — i.e. issues with which people would not have direct experience. And in 1985, Atwater, like others (Brosius et al., 1990; Suhonen, 1993; Makami et al., 1995; Ader, 1995; Hester, 1995), found that there was a relationship between the media's environmental agenda and the public's environmental priorities[4].

Interestingly, in direct contrast to environmental agenda-setting research that either theorized that the environment is an unobtrusive issue (Atwater et al., 1985), or actually tested that the environment was unobtrusive (Ader, 1995; Hester, 1995), later environmental agenda setting research (i.e. Gooch, 1996) pointed out that environmental issues could in fact be quite obtrusive. "Despite the amount of information provided by the newspapers on waste and water problems, the public felt most concerned about air pollution. Air pollution for many of the people answering the survey was directly observable — it was local, personally experienced and tangible" (Gooch, 1996).

THE COMMUNICATION OF CLIMATE CHANGE

Climate change is an environmental risk — caused by what we put into the air and manifest by changes in the earth's climate. And in the same way that we are dependent on the media to tell us about the environment, we rely on the media to tell us about climate change. In the same way, however, that agenda-setting researchers have gone back and forth on the question of whether the environment is an obtrusive or unobtrusive issue, it is not clear whether we should think of climate change as an obtrusive or unobtrusive issue. The climate is certainly obtrusive and we "interact" with it (i.e. via the manifestations of climate — temperature, rainfall, etc.) but is climate change obtrusive? Probably not. We have to be told what climate change is, how it manifests itself, and so on.

"When it comes to climate change, the facts completely escape common experience for it is only by communication that the issue is given meaning (as opposed to a daily occurrence such as a road accident, which ordinary experience has several ways of interpreting)" (Mormont & Dasnoy, 1995). And, if the facts completely escape common experience, it is from the media that we garner those facts.

Given that climate change is a relatively recent phenomenon (gaining "prominence" in the late 1980s), a fair bit of research has been done on the subject of how the media communicate the issue (McComas & Shanahan, 1999; Shanahan & Trumbo, 1998; Mormont & Dasnoy, 1995; Trumbo, 1995; Wilson, 1995; Bell, 1994; Wilkins, 1993; Clark et al., in press). And one of the themes that comes through in this research, loud and clear, is that the media messages about climate change are confusing.

Several of the researchers point to the fact that even what to call this phenomenon is confusing and somewhat "loaded." In *Between facts and values: print media coverage of the greenhouse effect, 1987-1990"* Wilkins (1993) found via content analysis that non-science writers preferred the label "global warming" when it is clear that Wilkins believes that "greenhouse effect" is the correct term. There is no reference at all in Wilkins's article to the term "climate change." In *Voices and messages in global climate change coverage* Shanahan and Trumbo (1998) note that the Washington Post and the New York Times, from 1985 to mid-1997, use the term "greenhouse effect" initially and then switched to "global warming" in 1990 (with climate change somewhere in the middle but slowly gaining). The authors theorized that "global warming" may have been coined in order to add drama to the story (i.e. "greenhouse effect" was not dramatic enough). In *Mass media as sources of global warming*[5] *knowledge* Wilson (1995) distinguishes between the greenhouse effect (the phenomenon of the carbon dioxide blanket making the earth habitable) and global warming (the human-induced phenomenon) and used this distinction as one way of measuring knowledge about climate change[6]. Interestingly, while these researchers are exploring and postulating about what to call climate change, their papers are demonstrating — and perhaps adding to — the confusion.

This concept of the media as a source of climate change confusion extends beyond what name to give the phenomenon. Bell (1994) looked at the press and broadcast coverage of climate change in New Zealand from March 15 to September 14. His findings showed that while a majority of the stories, 84 percent, were "slightly inaccurate" or better, the remaining 16 percent were moderately, very or extremely inaccurate[7]. And while the science of climate change is complex, and, therefore, scientists could be excused for getting the facts wrong from time-to-time, it is interesting to note that the inaccuracies did not occur both above and below the correct level (for rainfall, temperature, etc.) but ALWAYS above (i.e. always exaggerated). Which, as Bell points out, "effectively enhances the news value of the story for the news media" (Bell, 1994).

This confusion, however, need not emanate from actual inaccuracies. Researchers performing content analyses

(Wilkins, 1993; Shanahan & Trumbo, 1998) found that while scientists were most called upon as sources in the early climate change years (late 1980s), in the following years — as the issue got "hotter" and more contentious (i.e. those in positions of influence of one kind or another started to realize the implications of climate change) – government sources and interest group representatives were most called upon and "scientists came in a distant third" (Wilkins, 1993). Another example of a potentially problematic reporting practice is the way in which controversy is covered. Wilkins (1993) talks about the questioning of facts around climate change being presented as a " dueling scientist scenario." Shanahan and Trumbo expand on this concept by comparing the level of consensus on the issue with the level of consensus in the media. They found that, presumably in the name of "objective reporting," more or less equal space was being given to the "proponents" of climate change as the "naysayers."

What serves as a catalyst for climate change stories also has the potential to add to this climate change confusion. Wilkins (1993) found that just over 50 percent of climate change stories are related to a specific political event — international meeting, passage of an act, allocation of funds, etc. And while journalists' desire to coverage of such events certainly make sense, it raises the issue of what other information is made available about the issue in such an article (i.e. in focus groups that Rogers, 1999, ran the participants said that they found details about the issue missing from such "event articles"). An additional point that is raised by such articles is what happens when there are no "events" to cover — does climate change "disappear"?

And while climate change has in fact not disappeared but been a remarkably "steady" news story over the years, coverage has shown definite waxing and waning. McComas and Shanahan looked at the coverage of climate change in the Washington Post and New York Times from 1980 to 1995 and applied the concept of narratives to the coverage. "We argure that news media actively construct narratives about environmental issues like global warming and that these constructions are driven primarily by narrative considerations" (McComas & Shanahan, 1999). The implication is that narrative considerations are what drive the story such that there are three stages — waxing, maintenance and waning — and each stage "dictates" the aspects of climate change that are highlighted: consequences of climate change in the waxing stage and controversies among the scientists about the causes and impacts of climate change during the maintenance and waning stages. The conclusion is that the media storytelling structure has been constructed to sell stories and the story of climate change has simply been fit into that structure.

Researchers (Wilkins, 1993; Shanahan & Good, in press) have also found that there's a relationship between hot days (whether in an absolute or relative context) and increased climate change coverage. Wilkins's research showed that more than half of climate change stories appeared between April and August. Shanahan and Good's research demonstrated that on "unusual" days (i.e. when the temperature was greater than 15 degress above normal) there were significantly more words written in the New York Times than on more "usual" days.

These findings raise questions of whether an association is being made by journalists between daily local weather and long-term global climate (and whether such an association would then be passed along to readers) and what happens to coverage in periods of cooler weather, or in parts of the world less temperately affected by climate change?

Willkins takes this analysis of the coverage of climate change a step further by going beyond what is contained in climate change articles and looking at what is not there. Wilkins draws attention to the fact that science, while presented to us as being somehow objective, is in fact "far from being value-neutral [and] is the expression of particular sets of values." (Wilkins, 1993) And the same can be said of "objective news." For example, Wilkins points out that climate change stories often have "firsts" (i.e. discovery, progress) as their news pegs. "Progress, in these stories was often linked to a technological fix, and to a technocratic elite that would first develop and then control the solutions." (Wilkins, 1993) The symptoms, therefore, rather than the causes, were explored.

So, according to the research, what we learn about climate change from the media complicates and confuses what is an already complex story. But the studies also show that all media are not created equal. For instance, Clark, et al. (in press) found that those who obtain their information about climate change from newspapers, magazines, public radio and books have a higher level of awareness about climate change than do those who receive their information via other media. (television had no impact on level of awareness). And while the authors do not make claims about direction of causality, they offer that "the media do appear to be making some difference in public understandings of, and engagement with, global warming." (Clark et al., in press).

Wilson (1995) found that students who felt that their primary source of information about climate change was the classroom had the highest level of correct climate change knowledge while those who felt that television was their primary source had significantly fewer correct answers and more "don't know" answers. "[T]he media," Wilson concludes, "especially television, are an integral source of knowledge [albeit incorrect] about global warming" (Wilson, 1995). And yet when asked if they felt informed enough to participate as "informed citizens" in discussions about climate change, only 57 percent of the students in Wilson's study said yes (Wilson, 1995).

THINKING ABOUT THE RISK OF CLIMATE CHANGE

Where there is mortality; there is risk. Without the threat of such an ultimate loss, there might still be risks, but they would take on a very different quality. It is our mortality that serves as the backdrop for the balancing of risks. Sooner or later we will all meet our demise and we have no way of knowing how or when that will happen. Life is fundamentally risky. Somehow this reality tempers all other assessments of risk.

Early humans must have understood this notion of life as risky. "Poor, nasty, brutish and short" was how Hobbes referred to the lives of early humans. Whether or not this is in fact an accurate description, it is probably safe to say that there is more certainty in people's lives today — at least in the developed world — than ever before. As humans evolved, we moved toward a way of knowing, a way of interpreting the world around us, that provided some order, predictability and sense of mastery. That way of knowing and interpretation is the scientific method. It is a specific way of knowing based on reduction and repetition. Its practice requires a specific set of skills and understandings that must be mastered over time. As such, only those who are trained can perform it and the majority are left to accept that the results will have a positive impact on our lives.

Because Americans are born into a society where the underlying understanding is that science has given us this improved standard of living (i.e. in this historical context), and because so few of us are scientists, it is possible for us to afford science — and for science to afford itself — a level of objective certainty that it does not have. Zehr (1999) points out that "scientists and other science workers tend to gloss over the contingencies and other uncertainties of laboratory life as they reconstruct knowledge for public dissemination." Thomas (1987) offers that "The role of science in this world is cearcut: it must inform the analyses of risk" and that within the analyses, "the uncertainty of science butts up against the law's [read society's] rigid demands for certainty." (Thomas, 1987)

It is not that science cannot be certain (what we would call "certainty" exists in the cause and effect relationships that are established in labs). It is that the application of science to the "real world" can rarely be certain. And when the scale increases, the level of uncertainty also increases. And as has been discussed earlier, it is climate change is about as large-scale as it gets. Much of the projections that are done to determine the potential impacts that climate change will have are the result of massive computer programs that try to model the various systems involved. The systems, of course, are huge. "As the scope of these problems increased, so has the amount of scientific uncertainty," offers Zehr (1999) and he continues "Many of these issues and problems also entail nonscientific questions of morality, politics and economics that add to their complexity and to uncertainty."

In light of the complexity, the fact that climate change has been widely accepted by the world's leading atmospheric scientists seems quite an "endorsement" for its existence. Exactly how the phenomenon will play itself out — where, when, how much — is not known, may never be known, but, as was pointed out earlier, the IPCC concluded that there is a "discernable human influence" on the climate (EPA, 2000).

The scientists, therefore, say that climate change is happening, with an entire cohort of associated risks. And, as was explored above, the media present the information in what is an often confusing manner. What can we assume about how the public is processing the issue?

Tversky and Kahneman (1982) propose that because it is impossible for people to exhaustively survey all of the information we have floating around in our heads, when we need to evaluate the frequency or likelihood of events, we employ various types of "heuristics" (cognitive "short cuts") to assist us.

Tversky and Kahneman suggest two types of heuristic "strategies": representative and availability. The representative heuristic judges an event as probably "to the extent that it represents the features of its parent population or generating process…" Weinstein (1989) points out the link between the representative heuristic and stereotypes. He proposes that when we use this heuristic to, for example, determine the likelihood that we would develop a drinking problem, we rely on a few salient aspects — or the stereotype — of someone who has a drinking problem (i.e. a "wino") and see if the image we have of ourselves matches this image.

How can climate change be understood within this notion of representative heuristics and stereotype? It is quite reasonable to assume that we have representative or stereotyped images of what we think the "climate" is (probably synonymous with "weather" for most people and, as pointed out above, an association that may well be "encouraged" by the media's coverage of climate change) and how we think that the climate should be (the media probably also play a role in this, but daily existence would also play a large role). The questions that this raises are: What would it take for a person's representative heuristic to "kick in" such that s/he felt that climate change is in fact happening (i.e. what is the "stereotype" of climate change that people have garnered from the media (and other sources of climate change knowledge) such that when real world events looked like the stereotype people would say, "THIS is climate change")? If extremes in the weather are the most likely representative heuristic for the reality of climate change, what are the implications if these extremes are attributed to other climate related phenomena (i.e. El Nino, La Nina, etc.)?[8]

The availability heuristic is equally interesting. Tversky and Kahneman state that, " A person is said to employ the availability heuristic whenever he [or she] estimates frequency or probability by the ease with which instances or associations could be brought to mind." No doubt the availability heuristic is employed when we assess what constitutes usual and unusual climatic patterns (in our lived experience and in media representations).

For both the representative and availability heuristics it is easy to see two things: that we live and interact with manifestations of the climate (i.e. weather) our entire lives and that we are still dependent on the media for helping us to interpret what constitutes unusual weather and what the causes of that unusual weather are (if any causes are even given). It is interesting to note that no research exists (at least not that I have been able to find) in the area of how we interpret usual and unusual weather.

Another cognitive processing tool that is particularly important within a risk context is optimistic bias. In Optimistic Biases About Personal Risks, Weinstein describes optimistic bias as the tendency for people to underestimate their chances of encountering a negative event and overestimate their chances of encountering a positive event.

It is easy to assume that optimistic bias could be involved in a number of ways with the climate change issue. When extreme weather events are watched on the news, optimistic bias could lead people to believe that this could never happen to them (even when an extreme weather event is actually headed towards people's communities and homes, optimistic bias can lead people to believe that they won't be affected). When the weather is unusually nice, people could assume that this is what climate change is all about and when the weather is bad they could attribute it to something other than climate change.

Optimistic bias could also kick in around the actions people are undertaking, or not, to alleviate climate change (i.e. overestimating the positive "I carpool!" or underestimating the negative "What difference could my SUV make?"). This optimistic bias could also exist at the societal level where we overestimate the resiliency of the earth to "deal with" human activities, overestimate the positive impact of societal changes or underestimate society's impact.

Along these lines of the processing of climate change information that takes place at the societal level, it is perhaps obvious, but important, to point out that individuals do not process information in a vacuum. The social network perspective (SNP) assumes that individual attitudes, knowledge and perceptions are not the primary basis for individual or group perceptions but rather the social interactions that are key. The SNP looks at patterns between individuals (i.e. focuses on the relationships among social entities, and the patterns/implications of these relationships).

The important aspects of the SNP include: that actors and their actions are viewed as interdependent; that the links or relational ties between individuals allow for the flow of information; that the proximity of two actors within a social network is associated with the interpersonal influence between the actors (Scherer, 2000).

That risks are social constructions is not an intuitive, or, therefore, straightforward concept. It is much easier to understand risks, like science, as some sort of rule-based cause-and-effect unwavering science. However, as the social amplification of risk theory points out, "what human beings perceive as threats to their well-being and how they evaluate probabilities and magnitudes of unwanted consequences, are less a question of predicted physical outcomes than of values, social influences, and cultural identity" (Renn et al., 1992). The theory, therefore, proposes "events pertaining to hazards interact with psychological, social, institutional and cultural processes in ways that can heighten or attenuate individual and social perceptions of risk and shape risk behavior." (Renn et al., 1992)

Amplification (or attenuation) begins when an actual event takes place or some sort of awareness of an event or situation (i.e. climate change) is created. Individuals either attenuate or intensify messages/information that they receive (based on their existing belief/moral system). New information is put through eight steps of processing[9] and individuals can then act as "individual stations of amplification." At the end of those eight steps, whatever the conclusion an individual might have drawn is then affected by the values and beliefs of the groups in which the individual participates. "Role-related considerations and membership in social groups shape [by rewarding adherence to, and punishing deviance from their belief and value systems] the selection of information that the individual regards as significant" (Kasperson, 1992).

As information is processed by individuals as individuals, and individuals as parts of groups, there is a kind of ripple effect that takes place. Those most affected by the risk are at the center and the result of their processing — whether in the context of the individual, group, organization, etc. — emanates out. "The experience of risk is therefore not an experience of physical harm, but the result of a process by which individuals or groups learn to acquire or create interpretations of hazards. These interpretations provide rules of how to select, order, and often explain signals from the physical world." (Renn et al., 1992)

In Renn's 1992 application of the social amplification of risk one finding was of particular interest: Exposure is key. Therefore, if a few people are severely affected by a risk this will have less of an impact on the level of concern about the risk than if a much larger group of people is affected — even if the larger group is less severely affected. People's "use" of exposure as a key concept in risk evaluation is in contrast to the experts' use of magnitude of risk and probability of occurrence.

This aspect of the findings seem particularly important in the context of climate change. At least in theory, it would be difficult to find a risk with greater exposure. The key would seem to be (returning to a theme that has been mentioned several times) how people are understanding what they are experiencing. In many risk situations it is clear when a risk is present. The toxic plume of smoke is descending. Multiple vehicles are piled up on a highway. Defining the risk of climate change is a less tangible exercise.

THE COMMUNICATION STRATEGY

This is a three-pronged communication strategy based in the United States. The first prong is aimed at journalists and will focus on improved accuracy of climate change information. The second prong will focus on urban centers and has as its guiding concepts self-efficacy, reasoned action and the importance of reaching people in the diverse communities where they live and form their perceptions about the world. The third prong is aimed at political leaders — beginning municipally and rippling upwards — and relies on plain old fashioned political desire for votes as its guiding concept.

I. Accurate information about climate change

As has been explored above, the media have not done a particularly good job at conveying the issue of climate change. Certainly some of this reality has to do with the way in which the media have evolved to tell stories and the collision of the long timeline and complex uncertain science of climate change with the fast-moving simplistic mass media. However, some of it may also have to do with the fact that those crafting the stories do not have easy access to recent, straightforward, climate change information from reputable broad-based science organizations like the IPCC.

Audience

Journalists, producers and other creators of media messages (educators could also make use of the information).

Goal

To supply the audience with ongoing and current climate change information and "frameworks" for conceptualizing the issue.

Information needed

The vast majority of creators of media messages are not scientists and, therefore, they need climate change information in the same way that members of the public do. They need a forum where they can easily ask questions and get background information apart from the formal interviews that they conduct. Addressing facts and figures but also concepts like the "balance phenomenon" in the coverage of climate change (i.e. to explicitly talk about the problem of creating balance by having an equal number of climate change "proponents" and "naysayers") would be key.

Delivery opportunities

The best way to convey this information is via the internet. The internet is easy and fast to access, lends itself to regular updates, can include email and on-line chat for feedback and questions.

Evaluation

Some of the evaluation could be done by the media people and scientists via the activity and feedback on the internet. It would also be possible to track accuracy in reporting by tracking who is using the site (i.e. with their consent) and subsequent media products.

II. Alternative energy in urban centers

Climate change is not only complex, uncertain and extremely politically charged, but it is frightening. The idea that the very way in which we have structured society and live our lives from day-to-day could be affecting the actual climate of the planet is scary. And the list of potential consequences of climate change — that reads somewhat like a list of biblical plagues — does not help. The underlying message of this communication strategy is, therefore, efficacy.

The extended parallel process model (EPPM) is a theory of fear appeals (defined as "messages that evoke fear by focussing on severe and probable threats in order to induce adherence to recommended courses of action")

(Witte, 1995). Fear appeals tend to work like this: the receiver of the message is told that there is a serious threat; that the threat could very well happen to the receiver; that the receiver can do something about the threat; and that the recommended course of action will in fact work.

These stages of perceived threat, probability of the threat, self-efficacy and response efficacy initiate one of two reactions — danger control or fear control and it is efficacy that dictates which reaction "kicks in" (with the degree of threat dictating how strong response is). And this is the key: danger control causes people to heed risk message recommendations and fear control causes rejection. Therefore, "risk messages must not only depict the threat as severe and probable; to promote danger control responses, they *must* offer specific solutions that the public can easily carry out with a minimum of complexity and labor" (Witte, 1995). Other research (Dorsey, 1999) has shown that the role of self-efficacy is key in the reduction of risk.

The theory of reasoned action can also be seen as adding to the above concept of what might motivate people in response to information about risk. Ajzen (1988) offers that the theory of reasoned action "is based on the assumption that human beings usually behave in a sensible manner; that they take account of available information and implicitly or explicitly consider the implications for their actions" (Griffin et al., 1995). Further, people are more likely to behave in a manner that they perceive as positive and that they perceive "significant others" will view as being positive.

So, the individual needs to understand that there is a risk, that there are actions that can be undertaken to alleviate the risk, and that the actions are positive and will be perceived as such.

However, as has been talked about above, people are social creatures and this is key to the understanding and communication of risk. Risks are "created," comprehended and communicated within social settings. Therefore, in addition to the importance of self-efficacy and reasoned action, it is important to develop a communication campaign that consciously embraces this reality. "Receipt of information about risk will vary from community to community, among various publics within any community and through time" (Fessenden, 1987). Communities, and the individuals making up the communities, have histories and experiences that make them unique.

The audience

The communities that compose American urban centers are the focus of this second prong.

The goal

The goal is twofold: to link the often dramatic and frightening information about climate change with alternative energy and to emphasize that alternative energy is sensible in terms of cleaner air, less centralized power production, less reliance on foreign manufacturers, etc.

Information needed

People will continue to need information about climate change. Hopefully the first prong will have an impact on the quality of the media information they receive.

People will also need information about alternative energy in general and how they can get involved by demanding alternative energy options. The actual alternative energy options will be made available via existing providers (i.e. buying a percentage of home electricity via one's current hydro provider, having the city install a roof solar panel to provide hot water, buying an electric car from the car dealership and having the car's battery recharged at the solar recharging station, etc.). Therefore, in addition to needing to know about climate change and why alternative energy is good, information about where to find/how to access that alternative energy will be necessary.

Delivery options

Information about climate change will continue to be disseminated via the same channels as it currently is. Information about alternative energy would ideally be disseminated by the same media outlets (journalists might be persuaded to include some information about alternative energy if it is made available to them on a regular basis).

The more likely scenario would be a simultaneous launch of an alternative energy option (i.e. buying a percentage of your hydro from an alternative producer) and dissemination of information about why alternative energy is a good thing. This information could be passed along via the actual entity promoting the alternative energy (i.e. the hydro supplier, car dealership, etc.) and smaller-scale media like billboards, subway posters, etc.

Another approach might be to work with community organizations to identify opinion leaders — individuals who are able to informally influence the attitudes or behaviors of others in a desired way with relative frequency (Rogers, 1995) — and facilitate their engagement with a particular program (i.e. have a solar panel put on their house).

Evaluation

As there is ongoing research around the communication of climate change (as there is sure to be), content analyses, audiences surveys, etc. will be a good indicator of whether the quality of climate change information is improving.

The evaluation of alternative energy involvement can be assessed according to the specific "campaign" (i.e. how many people are participating in each of the initiatives).

III. The politicians

"Threshold models of collective behavior postulate that an individual engages in a behavior based on the proportion of people in the social system already engaged in the behavior" (Valente 1995, citing Granovetter 1978). And, I would propose, the threshold model applies to politicians. Once enough people are engaged in a behavior, in general, the politicians will follow. Threshold theory goes on to postulate that it is not so much the absolute number of people engaged in the behavior that affects another person's likelihood to adopt the behavior, but the percentage of relevant people who have engaged. I would add that this too works for politicians. Relevant people (i.e. people with some sort of influence — money, community profile, etc.) wield more influence.

Audience

Municipal politicians would be the first to be "targeted" and then as the various initiatives took hold, it would be hoped that the threshold effects would kick in again and state and eventually federal politicians would begin to take note.

Goal

To have politicians increasingly associate alternative energy with energy that is not only improves air quality but is good at combating climate change, alleviates the pressures that can come from a centralized sources of energy, can be touted as "American," etc.

Information needed

Municipal politicians will need to know about alternative energy in general and what specific proposed projects would entail in particular. If it is possible to launch a pilot program (i.e. buying a percent of home energy produced via alternative means) and demonstrate the demand before actively involving the politicians, that might be best.

Delivery options

Politicians are very conscious of the "pulse" of their constituents. If opinion polls are conducted demonstrating concern about global warming, this should convey a strong message to the politicians. Participation rates for alternative energy campaigns would be important. And coverage of the various initiatives via the mass media would be effective.

Evaluation

Adoption of alternative energy campaigns would be the key evaluation tool.

CONCLUSION

As risk communication issues go, climate change contains some very interesting ingredients. The scale and complexity of the issue are perhaps unprecedented. There is every reason for the risk to be downplayed (in a world based on burning fossil fuels, and where those who are in any way involved with the supply of fossil fuels wield tremendous influence, who wants to accept that the burning might have to stop?). And yet there is every reason to proceed with addressing the risk as the alternative energy solutions stand to not only address the reality of climate change, but the quality of our lives as well.

The experience of climate change is both unknowable and as intimate as essence of the world in which we live. And the communication of climate change is both full of opportunities and challenges. The concept of the social construction of science and risk is alive and well in climate change. The opportunity to work with communities to understand climate change in its complex scientific and social realities, and to implement alternative energy programs, is exciting. And the challenge of engaging the producers of media messages such that they are able to talk about climate change in an accurate and thoughtful manner is no less so. ❑

FOOTNOTES

[1] Renn et al. use the qualitatively loaded "advances." Science and technology have certainly allowed for technological change, had an affect on lifestyles and social structures and radically changed how we as humans intervene in nature. When viewed using certain filters (i.e. the rate at which species are becoming extinct, the prevalence of toxic chemicals throughout the environment, etc.), it is possible to be justified in wanting to temper the "advances" with something less value-laden like "changes").

[2] I have thought a fair bit about this concept of the scale of climate change relative to the scale of other human "created" risks. It is probably fair to say that few other risks have ever had the global implications that climate change has (nuclear war and perhaps toxic contamination — i.e. that people everywhere in the world now contain traces of industrial chemicals in their bodies — being the only other risks I can think of). The point I want to make, however, is that while the reality of other risks may not have existed on the same scale, there were no doubt fears that risks had such implications. First eclipses of the sun, various plagues, etc., no doubt felt like significant global, potentially apocalyptic, risks.

[3] DeFleur and Dennis's thoughts on media dependency are useful, but place media dependency squarely in a social context (i.e. urban-industrial society actually limits our social interaction and, therefore, social learning). Urban-industrial society limits another equally important interaction — our interaction with the environment. This is an issue which will resurface throughout the paper.

[4] Atwater found a moderate correlation between intrapersonal agendas and media agendas and a significant correlation between the public's perception of the media agenda and the media's actual agenda. Brosius et al. looked at time lags and the question of direction of correlation (i.e. media to public agenda and vice versa). They found that the importance of time lags depends on the issue and level of awareness of that issue; the direction of the correlation depends on the intensity and degree of variation in the coverage of the issue (i.e. television's agenda was likely to influence the public agenda when coverage was intense and variation large). Suhonen showed that for the 15 years studied, concern for the environment was related to the amount of press coverage devoted to it. Makami et al. concluded that the more respondents watched tv, news about environmental problems, the more they were likely to identify environmental problems as important. Ader also found an agenda-setting relationship.

[5] The underlining in the titles was added to emphasize that the three articles made use of three different names to refer to the same phenomenon.

[6] It seems appropriate to offer a few words about the choice to use "climate change" in this paper. The Environmental Protection Agency refers to the Greenhouse Effect as a "natural phenomenon" (i.e. the concept that the greenhouse effect is in fact what allows life on earth to exist). "Global warming" is understood to be the key result of the anthropocentric exacerbation of this naturally occurring "greenhouse effect" but the warming will cause a host of climatic changes such as an increase in extreme weather events, changes in rainfall patterns, sea level rise and so on. In light of this variety of consequences for the warming of the climate, it seems most appropriate to label the

phenomenon climate change.

[7] There were six types of inaccuracies: scientific/technical inaccuracies, technical terms misused, wrong figures given, scientific facts confused, non-scientific inaccuracies and misquotations.

This is the questthe second stage of this paper will address.

[9] 1. Passing through attention filters 2. Decoding of signals 3. Drawing inferences 4. Comparing the decoded messages with other messages 5. Evaluating messages 6. Forming specific beliefs 7. Rationalizing belief system 8. Forming a propensity to take corresponding actions (Renn et al., 1992).

Media Narratives of Global Warming

Mark Meisner

The mass media are a key channel in the discourse of global warming. How they present the issue and proposed responses to it will influence how the public and decision-makers perceive and respond to it. A qualitative analysis of recent (1999-2000) media representations of global warming suggests that global warming is now largely accepted in the media. However it is being framed very restrictively. Mass mediated constructions of global warming offer up a limited selection of problem definitions, reasons for acting, and ways of addressing global warming.

INTRODUCTION

It was a dark and stormy night thirty odd years after the first Earth Day in 1970. Storms raged outside her mansion on the hill and Mother Earth was fitful and anxious. She knew that environmental issues were no longer the delinquent offspring of Industrial Revolution. They were now an experienced outlaw gang on an accelerating senseless crime spree.

And who was the poster child of crimes against Mother Earth and her own good children? None other than "Global Warming" (aka "The Greenhouse Effect", "Climate Warming", "Climate Change"). Seldom seen, but often spoken of, Global Warming could strike anywhere at any time. Now some doubted his (or was it her?, no one knew) existence, saying he was a myth. Others believed the legend and feared him mightily. But as I said, few had ever seen him perpetrating his vicious crimes; they knew only of the consequences.

And no one really knew where or how he would strike again or if his rumoured grand plans for the future would come to pass. Thus he was almost impossible to apprehend, let alone try (all those appeal courts are murder) or convict. And even if, by some miracle he could be sentenced, no prison could hold him, for his allies were everywhere, even within the justice system!

And so, realizing this, Mother Earth and her children came to decide that the best thing they could do was to try to carry on with their lives and simply learn to live with Global Warming and his partners in environmental crime.

The End.

OK. Let me try that again.

In many ways, environmental degradation in the year 2000 is much worse than it was in 1970. Environmental issues are many and varied, from the destruction of habitats and the extinguishing of species to a range of chemical pollution of lands, waters, and bodies. And perhaps the most challenging environmental issue of them all is global warming.

Global warming refers to the increase in the surface to lower atmospheric temperatures of the Earth. Anthropogenic or human-caused global warming is generally thought to be caused by the build-up of excessive amounts of so-called greenhouse gases in the atmosphere. These include carbon dioxide (CO_2), methane, and nitrous oxide

(NO_2). Their build-up is widely considered to be largely the result of humans burning up excessive quantities of fossil fuels, though other factors including animal flatulence also come in for some blame.

Global warming does not simply mean a steady rise in average temperatures across the board. It means somewhat unpredictable changes in temperature and climate around the world with varying local and regional effects. And, while extreme weather events such as hurricanes, floods and droughts are predicted by computer models of global warming, specific instances of them cannot be definitively linked to global warming. Global warming is happening; we just don't know how bad it is going to get.

It is no longer a matter of debate about whether it is happening, it is now a debate about what, if anything to do about it. We could do nothing to try to mitigate it and simply try to adapt to global warming. Or we could take any range of actions to try to slow down and reverse global warming.

There. That's better, isn't it?

So what does all this have to do with media narratives of global warming, the advertised topic of this paper? Well, since the paper is all about how the media talk about global warming, it seemed appropriate to illustrate two quite different styles of global warming discourse, and two substantially different narratives of global warming.

This paper, then, describes a research project that explores how recent print media texts narrate global warming. The questions guiding this work are: how is the global warming story being framed; how are nature and humanity's relationship to nature being presented; what types of responses to global warming are being presented; and who is responsible for acting to prevent or mitigate global warming?

The main arguments that will be advanced are that media narratives of global warming are no longer primarily stories of duelling scientists debating the existence of global warming. Rather, they now largely accept global warming as a reality. However, they continue to construct the problem in narrow technical, economic, and ultimately anthropocentric terms. Furthermore, these constructions are only likely to promote futility, denial, and/or apathy on the part of the public.

Before getting to the specifics of this study, brief introductions to the social construction of environmental problems, narratives and the media, and media coverage of global warming are in order.

THE SOCIAL CONSTRUCTION OF ENVIRONMENTAL PROBLEMS

The idea that environmental problems are socially constructed is not new, but it is controversial. For many in the environmental movement, environmental issues and problems are as plain to see as the nose on your face. To them the suggestion that environmental problems are social constructions is akin to wilful blindness and denial of urgent threats to life on earth (see Hannigan 1995; Soulé and Lease 1995). Fair enough; this is not an attempt to suggest that the issues are made up, as some anti-environmental types might argue.

Rather, in this context, suggesting that environmental problems are socially constructed refers to the fact that the ways in which we understand environmental and social conditions and the meanings we give to them are produced through human communication choices. As John Hannigan puts it, "a social constructionist approach...recognises the extent to which environmental problems and solutions are end-products of a dynamic social process of definition, negotiation and legitimation both in public and private settings" (Hannigan 1995, 31).

The social construction of environmental problems means neither that conditions are ipso facto objective, nor that they are entirely the products of human thought. Katherine Hayles (1995) refers to a middle ground between objectivism and solipsism as "constrained constructivism." "Neither cut free from reality nor existing independent of human perception, the world as constrained constructivism sees it is the result of complex and active engagements between the unmediated flux and human beings"(Hayles 1995, 53-54). Hannigan refers to the same idea as "contextual constructionism."

Joel Best explains the relationship between objective conditions and social constructions of social problems, using the example of ozone depletion:

> Our sense of what is a social problem is inevitably subjective. This is true, even when the problem seems purely objective. Thus, most scientists now agree that certain manufactured chemicals damage the ozone layer in the Earth's atmosphere, a process that threatens to increase the incidence of skin cancer, to damage crops, etc. This might seem to be a clear example of a harmful objective condition. But, again, this social problem has a subjective history. Scientists had to spot the loss in ozone, identify its cause, and bring it to public attention. The chemical industry resisted these claims, denying that there was a serious problem or that their chemicals were responsible. Politicians and the press began paying attention to the debate. In other words, people developed a subjective sense that this was a social problem. Suppose that no one noticed the declining ozone levels, or that politicians and the press refused to take the issue seriously. The objective condition (diminishing ozone) still would have had effects (more cancer, etc.) but it would not be on anyone's list of social problems. No condition is a social problem until someone considers it a social problem (Best 1995, 4-5).

Thus, our representations of the world, including those of environmental problems, can never be entirely and completely "true," since there is no place to stand from which to judge their accuracy. Representations can only be compared to each other, not to reality (Hayles 1995). Some may be more complete than others, but a map can never be the territory (Evernden 1985).

In the arena of public discourse, numerous potential social problems compete for attention, with success going to those whose claims become legitimised. Thus, we can study the process of claimsmaking around competing issues as they jostle for space and attention. Through the claimsmaking process, claimsmakers will present their perspectives on the conditions that will form the basis for a definition of a problem that has caused the condition. I prefer to think of it as issues (what we see, e.g., pollution) being the symptoms of problems (what causes the issue, e.g., human error, lawbreaking, technical shortcomings, capitalism, etc.) For every issue there are many potential problem definitions. This process of problem defining is sometimes referred to as "typification." Best explains:

> Typification occurs when claimsmakers characterize a problem's nature. Typification can take many forms. One of the most common forms is to give an orientation toward a problem, arguing that a problem is best understood from a particular perspective. Thus, claimsmakers assert that X is real ___ (moral, medical, criminal, political, etc.) problem. Each orientation emphasizes different aspects of X. Typically an orientation locates the problem's cause and recommends a solution (Best 1995, 8-9).

In addition to the concept of typification, social constructionism employs several concepts around the claimsmaking process. These are the grounds, "the basic facts which shape the ensuing claims-making discourse," warrants, "the justifications for demanding that action be taken," and conclusions, "the action which is needed to alleviate or eradicate a social problem" (Hannigan 1995).

So, central to this study is this idea that different participants in a discourse, in this case of global warming, will seek to define the problem in ways that suit their proposed solutions or ideologies. Different definitions of the problem underlying the global warming issue will be proposed and taken up in the media through a process of competing claims.

NARRATIVES AND THE MEDIA

Narratives are essentially stories. They have plots, characters and themes, and they tell of events that have happened. Why are they important? Because as Arthur Asa Berger (1997, 9-10) reminds us, from childhood to death, "narratives pervade our lives....they furnish us with both a method for learning about the world and a way to tell others what we have learned." Narratives are one of the most important ways that we socially construct our understanding of reality.

Narratives can be found throughout the mass media. From news "stories" to TV dramas, feature films to advertisements. Some narratives are easily identifiable stories, as in serialised dramatic television shows. In other media texts, print advertisements for example, it may not always be obvious that there are narratives at work. But they are, even if just in an implied form. In an advertisement, for example, there is always the implied story about how your life will be transformed by buying the product.

The mass media are important sources of narratives for several reasons. First, the media are pervasive. They surround us and provide near constant exposure to media texts, most of which have narrative qualities. Second, the media have displaced religion and the education system as the dominant socializing and storytelling institutions in our society. Thirdly, the media are influential. Though individuals read media messages in different ways, the messages do matter for they offer not just information, but also beliefs, values, and ways of seeing. They tell us what is normal and what is deviant and they help us structure our identities.

Thus the mass media affect everything from our relations with government and politics to those with our family and friends. Indeed, they help define our culture and our ideologies, primarily the culture of consumption and ideology of consumerism that characterise this society. Together these reasons combine to suggest that the media have tremendous social power, the power of meaning formation (For a good introduction to the media and society see Croteau and Hoynes 2000).

When it comes to environmental issues, the same is true of the media. They help us generate our understandings of issues by acting as a central node for the circulation of environmental claims. The media sit between the public and the policy makers, the activists, the scientists, industry and other environmental discourse participants, all of whom, in part, communicate through the media. And this discourse of competing narratives and competing claims takes place not just in news coverage, but also in entertainment and other genres of media texts.

In this paper, however, the focus is on narratives in newspaper and news magazine accounts of global warming. The texts being considered include a limited range of genres: features, news reports, notes, editorials, reviews, columns and letters to the editor. Obviously, this is only a small range of types of media texts, but newspapers and newsmagazines are considered by scholars (though not the public) to be most reliable sources of news.

MEDIA COVERAGE OF GLOBAL WARMING

Some work has been done on how the media have covered global warming which I will now briefly consider.

Allan Bell (1991; 1994) was concerned with the accuracy of reporting and of the perception of media content. His work attempted to measure the gaps between the science of climate change and how it is reported (i.e., the degree of mis-reporting) as well as between the reporting of climate change and how it is perceived by the audience (i.e., the degree mis-understanding).

In looking at the mis-reporting gap in relation to climate change, Bell (1991) found considerable evidence of such things as overstatement, misquotation, misattribution and exaggeration. In looking at people's understanding of climate change issues and comparing these with media representations from the previous year, he found that there was a considerable mismatch between the two (1994). Examples of this include the over-estimation of temperature and sea-level rises and confusion of global warming with ozone depletion.

This research tends to presume a kind of reflection theory of the media, the idea that media reporting can mirror the non-mediated world, whether it be of science or any aspect of social life. In this case, Bell seems to presume both that reporters could construct fully accurate reports of climate change and that audiences could unambiguously understand such media messages. This kind of approach does not fit with the current study, but it is somewhat instructive.

Sheldon Ungar (1992) looked at a variety of media in the late 1980's to see how global warming was being characterized. He found that the claims of scientists about the likelihood of global warming failed to attract much attention until the summer of 1988 which was very hot and dry in North America. He argued that it was these real world events that legitimized the scientific claims and gave them political currency.

Lee Wilkins (1993) conducted a large study of over 1400 stories about global warming (the greenhouse effect) from 1987-1990. His interest was in news values and he found three important values that framed news of the greenhouse effect: progress, the institutionalisation of knowledge, and innocence. He argued that these values reflected the values of the scientific community and that they tended to exclude the consideration of ethical choices. Furthermore, "progress, in these stories, was often linked to a technological fix, and to a technocratic elite that would first develop and then control the solutions" (1993, 77). In his view, these stories did not generally look at the roots of the problem. And, though facts were questioned through the duelling scientist scenario, with equal time to both sides, non-experts were rarely acknowledged.

Craig Trumbo (1996) was interested in how climate change was constructed as a problem by the media from 1985 to 1995. Employing a claimsmaking perspective, he looked at the distribution of claims and frames by different news sources (claimsmakers), including politicians, scientists and interested parties. Among his findings were that scientists were less dominant as sources as the issue attention cycle progressed. In conjunction with this, there was a shift away from a discussion of causes to more of a political debate and discussion of possible solutions.

Jim Shanahan and Katherine McComas have studied media coverage of climate change issues extensively, using primarily quantitative methods (McComas and Shanahan 1999; Shanahan and McComas 1999). In one study they looked at the themes that emerged during different phases of attention to climate change between 1980 and 1995. Among other things, they found that, "the dangers and consequences of global climate change were significantly more prominent in stories during the period of increased newspaper attention, and scientific controversy was more prominent in the maintenance phase" (McComas and Shanahan 1999).

Shanahan and McComas also have an interest in narratives of global warming, in particular how the narrative of global warming has evolved over time and in connection with the issue attention cycle (Shanahan and McComas 1999). They tracked both the fluctuations in the volume of global warming coverage and changes in its presentation from 1980-1994. Coverage rose dramatically in the late 1980's and declined in the 1990's. In conjunction, the narrative on the issue went from "imminent disaster" to extreme scepticism.

Lydia Dotto (2000) recently argued in *Alternatives Journal* that the problem in the discourse of global warming has been an unreasonable focus on the question of incontrovertible proof of global warming's existence. This, she argues, has distracted us from the more important debate about the consequences of global warming.

Finally, writing in the current issue of the *Ryerson Review of Journalism*, Simon Smith suggests that the Canadian media are failing to cover global warming adequately for several reasons. These include journalists misinterpreting scientific findings, the media's economic conflicts of interest, vociferous public relations from the fossil fuel industry, the unwillingness of scientists who believe global warming is happening to make strong statements to that effect on the record, and the failure of many journalists to report on energy alternatives that mitigate the connection between economic output and the consumption of fossil fuels. In essence, then, "media organizations focus on the economic implications of fighting climate change and fail to convey the dangers of inaction" (Smith 2000, 82).

METHODS

Climate change is not going away, nor is media coverage of it. There have certainly been cycles of media attention to the issue and there will be more. The current study is an attempt to take a snapshot of the North American print media coverage of global warming at the turn of the millennium. It is a qualitative study of the narratives and claimsmaking around global warming in a range of recent print media texts.

The Lexis-Nexis general news archive and the Canadian Periodical Index were used to obtain copies of a selection of articles that contained at least one of three search terms within the full text of the articles. The terms were "global warming," "climate change," and "greenhouse gas," as it was thought that these would catch most of the articles about global warming. The media outlets sampled from were the newsmagazines *Maclean's* and *Time*, and the newspapers *The Globe and Mail, The National Post*, and *The New York Times*, all elite media of record in their respective countries. The period of the sample was from January 1, 1999 to May 31, 2000. Though the search produced many more results, a manageable sample of 140 articles was purposively selected for qualitative narrative analysis. This analytical sample was intended to incorporate a range of types of print media texts, from short notes or longer unrelated stories that may have used the search terms simply in passing to longer articles whose focus was global warming. I wanted to see the range of uses of terms like "global warming" as well as how the issues themselves were being represented in detail.

A Filemaker database was created to store information about each article in the sample and to use in the actual analysis. The basic fields in the database included the medium, the outlet, the genre of text, the date of publication, the full text of the article, a description, the title, and the author. The analytical fields included repeating fields for claimsmakers; their acceptance of global warming; and their grounds, warrants, conclusions and typifications relating to global warming, as well as a single field for the narrative.

Each article was analysed and interpreted for the presence of each of these elements. It should be noted that not all elements were found in every text. Certainly in longer texts that provided major treatments of the global warming issue, most elements were present. But in many articles completely unrelated to global warming, such as a *Time* feature entitled "Fun with E-Mail," where global warming is simply mentioned in passing (in this case as something people talk about on Internet email lists), the direct claimsmaking elements with respect to global warming were absent.

The perspective used in analysing these texts is rooted in this idea of the social construction of environmental problems. It is further informed by recent environmental philosophy that emphasises the analysis of competing worldviews or environmental ideologies (See, for example, Evernden 1985; Evernden 1992; Fox 1990; Livingston 1994; McLaughlin 1993).

Four meta-analytical questions guided the analysis:

- How is global warming being typified?
  (e.g., technical, political, ethical problem, etc.)
- How are nature and humanity's relationship to nature being presented?
  (e.g., anthropocentric-resourcist, biocentric, or ecocentric environmental ideologies)
- What types of responses to global warming are being proposed?
  (e.g., policies, technical fixes, lifestyle changes, adapt)
- Who is responsible for acting to prevent or mitigate global warming?
  (e.g., government, industry, individuals)

To get at those questions, more focused analytical questions were put to the texts being analysed:

- Is global warming accepted as a fact?
  i.e., is there an issue? (the initial claim)

- If accepted, then how do we know global warming is happening?
  i.e., how do we know there is an issue? (the grounds)
- If accepted, then why is global warming happening?
  i.e., how is the problem defined? (the typification)
- If accepted, then why should action be taken?
  i.e., what justifies a course of action? (the warrants)
- If accepted, then what action, if any, should be taken?
  i.e., what course of action should be taken? (the conclusions)

DISCUSSION

First of all, the texts generally reflected three types of treatments of global warming: passing (the simple mention of one of the search terms); minor (the brief discussion of global warming in an article about something else); and major (global warming or some aspect of it as the focus of the article).

One might be quick to dismiss the passing treatments as being less relevant than the minor and major treatments. However, they occur sufficiently frequently to be worth consideration. In almost all of these cases, the passing references to global warming contained the implication that it is a real phenomenon; there was an implied acceptance of global warming. For example, in that *Time* article "Fun with E-Mail," global warming is used as an example of the profound topics discussed on mailing lists: "discussing everything from global warming to nose hair." The implication being that global warming is an important topic. Similarly, in a *Globe and Mail* article from January 4, 2000, global warming was mentioned as the type of real issue that we shouldn't neglect simply because the Y2K "bug" didn't end in apocalypse as some predicted. In the texts analysed, passing references to global warming and climate change almost always contain the implication that they are a reality, even if the references don't say anything more about their causes or consequences.

In general, the texts in this study presented global warming as something that is happening. With some notable exceptions, few of the authors or articles outright denied the existence of global warming. That is not to say that there was no dissent, for there were still sources quoted, including scientists and industry people, who continued to dispute the scientific evidence of global warming. But for the most part, it looks like the discourse is now moving past the debate over the existence of global warming.

The most notable exceptions to this came from the editorialists at the *National Post* led by editor Terrence Corcoran, formerly of the *Globe and Mail.* In his view, global warming is "the mother of all long-term scares" and "a scientific muddle and politically a total non-issue to most North Americans," and is supported only by "junk science." The Kyoto agreement is a "Stalinist plan," and "a monster of economic absurdity." And the Climate Change Action Fund is "a giant national pork barrel for researchers and propagandists."

Corcoran's rhetoric is the source of frequent earnest rejoinders in the form of letters to the editor and counter-editorials by the likes of environmentalist David Suzuki, as well as much laughter within the Canadian environmental community. Dan Westell put it succinctly when he suggested that Corcoran allows his extreme right-wing beliefs to "overtake the facts" (quoted in Morton 1995, 20). Though less colourful in their language, the other *Post* editorialists are equally zealous in their arguments against action on global warming.

The claimsmakers represented in this sample were the usual suspects, consisting mostly of the journalists and other authors of course, scientists, environmentalists, government officials, politicians, fossil fuel industry spokespersons, and think-tank spokespersons. This range of sources is in line with the media's usual reliance on official and established sources and tendency to leave lay-persons out of the picture, except, of course, in the case of letters to the editor. Just as Wilkins (1993) found, non-experts are not part of the mediated global warming discourse.

The grounds used to support the claim that global warming is happening were also mostly predictable. They included references to scientific studies of global temperature increases, regional temperature increases, glacial retreat, thinning polar ice, and carbon dioxide levels in polar ice. The grounds used also included anecdotal reports of northern ice roads melting, calving polar ice, coral reef die-offs, increasingly severe storms, and regional and local weather changes. Finally, extreme weather events such as floods, droughts, and hurricanes were also used, less often mind you, as evidence of global warming.

Where global warming was accepted as a real phenomenon, it was typified in a very narrow range of ways. These included that the problem was the use of fossil fuels, the excessive use of fossil fuels, reliance on fossil fuels, greenhouse gas emissions, excessive greenhouse gas emissions, an economic challenge, and simply global warming itself. For some claimsmakers who acknowledged the existence of global warming, it wasn't a problem at all, but simply part of a natural cycle or an opportunity.

Where action on global warming was advocated, a fairly limited range of warrants was offered. These included the damaging effects of unpredictable and extreme weather, including floods, droughts, and hurricanes; the damaging effects of a rise in sea levels, particularly to coastal communities; the damaging effects of inland waters drying up; the spread of diseases; a general threat to human health; the costs of increased health care; the costs of paying out insurance claims; the impairment and possible failure of human agricultural systems; the vulnerability of civilisation as we know it; and occasionally the threat to wildlife, including the extinction of some species.

A similarly narrow range of conclusions or "solutions" to global warming appeared in these texts. These included doing nothing, reducing greenhouse gas emissions, reducing greenhouse gas emissions to meet Kyoto, reducing greenhouse gas emissions only insofar as it could be done without hurting the economy, reducing fossil fuel consumption, carbon taxes, developing new technologies, increasing energy efficiency, investing in renewable energy sources, converting to renewable energy sources, trading emissions credits, producing "cleaner" more fuel efficient cars, promoting biotechnology solutions, conserving energy, increasing use of nuclear power, having politicians provide more leadership, increasing computing power for better prediction, expanding research efforts to better understand global warming's causes and effects, preparing for global warming and adapting to it, increasing public awareness of global warming, strengthening policies, and treating cow food to reduce the animals' methane output. Some of these are obviously quite vague others quite concrete.

Finally, we come to the narratives. In terms of the texts that focussed on global warming, six major narratives of global warming were discerned in this study. They are:

1. There is no conclusive evidence of global warming; environmentalists are perpetrating an alarmist myth in order to gain support for their organizations.
2. To the extent that global warming is occurring, it is the result of natural cycles, so there is nothing to worry about.
3. Global warming is happening, but it would be far too costly to the economy to take the measures suggested by Kyoto not to mention exceeding the Kyoto standards.
4. Global warming is happening and it will bring benefits, so we should enjoy the warmer climate and otherwise take advantage of its effects on northern agriculture.
5. Humans have caused global warming, but we can't stop it, so the best thing to do is prepare for and adapt to it.
6. Humans have caused global warming and the consequences will be severe; we must act now and decisively to mitigate its impacts, slow it down and ultimately reverse it.

It should be noted that these narratives didn't necessarily appear in these forms in the texts, and that sometimes these narratives were combined with each other. This list is a distillation.

CONCLUSIONS

This has been a small study of a limited range of media texts. A study of content such as this will not pass the tests of quantitative researchers and it offers no guarantees of providing the full spectrum of constructions of global warming. Furthermore, it cannot account for the ways that people idiosyncratically consume media texts about environmental issues, nor can it account for all the factors that shape a media text, let alone a discourse. Any conclusions must be seen in this light. That said, there are some points to be made about how the North American print media, as represented in this sample, are representing global warming.

One might want to be hopeful that in these texts there is acceptance of the fact of global warming as well as some scepticism about the public relations campaigns of interested parties. Those are minor victories. However, it isn't going to be a Hollywood ending.

First of all, the mainstream mass media studied here are mostly constructing global warming as a technical and economic problem, as can be seen from the lists of typifications and conclusions above. These texts almost completely neglect the fact that global warming is also a problem of human ethics and values, not to mention lifestyle and political economy (e.g., industrialism). For problems to be solved without creating residue problems, they must be accurately identified and it is my impression that that is not happening here.

Second, the responses to global warming, as seen in the narratives and conclusions, are also limited to semi-concrete technical measures and vague policy and economic measures. There also at times seemed to be an acceptance of global warming as inevitable. This is not going to solve the problem, whatever it may be.

Third, non-human nature is largely absent from this discourse. With the exception of the occasional mention of impacts on wildlife among the warrants for dealing with global warming, non-human nature is not an object of concern to the claimsmakers represented in this study. It is all about impacts on human health, property and wealth. Furthermore, the narrative possibilities offered up by these texts are firmly rooted in the hegemonic anthropocentric-resourcist ideology of nature.

That, to some, is the real problem behind environmental degradation, including global warming. Addressing it properly means not just technical, economic, or political responses, but cultural and spiritual ones as well.

Judging by these texts, it seems that the public is to stand by and wait for either new rules from governments, new energy efficient cars to buy, or similar institutional responses. In these texts, addressing global warming is the concern of governments and industry, not the public. Individual and collective democratic agency appears not to be an option. The techno-fix will come from above when it's good and ready.

As can be seen from the list of narratives, most of them offer ways out of dealing with global warming head on. This will be discouraging for those trying to promote action against global warming. Now, since this is not a quantitative study, it may be that narrative #6 dominates the discourse (I didn't have that impression). It is clear that even though the naysayers have backed down from the uncertainty of warming line, their filibustering continues along the lines of the costs of acting and the uncertainty of exact outcomes. Proponents of action to prevent/mitigate global warming have a long way to go in terms of getting the media on side.

And then from the reader's perspective, the range of narratives the public is being offered are too narrow and the only one that lets us address global warming head on offers nothing in the way of enticement to action. It is, like other narratives of environmental degradation, lacking in vision and hope. It is tinkering with the course of a super-tanker that urgently needs turning around 180 degrees. And perhaps people know that and are responding with denial, apathy, and/or futility.

Because of the perception of there being high social and economic costs involved, and because of intense lobbying by vested interests, national governments in the U.S. and Canada have been slow to seriously begin to address global warming. And until there is an undeniable wave of public opinion in favour of taking such action, policy makers will continue to hesitate. The only way to generate that level of public opinion is through the media, and everyone involved in the debates knows that. But without the legitimation that institutional leadership brings, the media are less likely to take up the issue vigorously. If Al Gore can't step up to the plate on global warming, who can? And with a media that only weakly reports on and narrowly constructs global warming, the likelihood of action goes down further. It is a Catch-22 of sorts isn't it? ❑

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Session B 3

NATIONAL & REGIONAL COMMUNICATION STRATEGIES 2: INITIATIVES FROM THE US NATIONAL ASSESSMENT

The Upper Midwest Aerospace Consortium Environmental Information Network: Building 'Learning Communities' in the Northern Great Plains
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Native Peoples / Native Homelands Outreach
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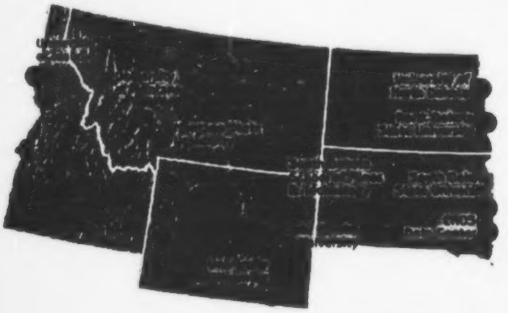
The Upper Midwest Aerospace Consortium Environmental Information Network: Building 'Learning Communities' in the Northern Great Plains

Leigh Welling, George Seielstad, Pat McClurg and Dan Fagre

In the last two decades alone, the U.S. and large portions of the world have witnessed what can be aptly be described as an explosion of scientific information and technological innovations that has permeated almost every aspect of our lives. Given these trends, it is clear that science and the understanding of science are becoming increasingly more relevant and essential to decision-makers and the decision-making process. Every environmental issue confronting society has an undisputed scientific underpinning. Understanding the implications of the science underpinning issues of particular importance to the health and well being of society constitutes the basis for making more informed and enlightened decisions. However obvious this linkage may be, many factors continue to serve as impediments to the broader understanding and incorporation of science into policy- and decision-making processes, as perhaps is best exemplified by the case of climate science.

INTRODUCTION

Agricultural producers, educators, foresters, land managers, state and local representatives, and other residents from the northern Plains states have identified lack of accurate and timely information as a critical gap in their ability to make decisions affecting their economic well-being and the quality of their lives. In this region the environment has an immediacy that impacts their daily lives to a greater extent than in less rural areas of the country. The major economic drivers of food and fiber production and of tourism are heavily weather, hence climate, dependent. Weather extremes - heat and cold, flood and drought, tornadoes and hailstorms, blizzards and ice storms - frequent the region enough that they govern many activities. The Upper Midwest Aerospace Consortium (UMAC) is committed to filling the environmental information gap through a variety of educational formats that reach people of all ages. The consortium stands as an interface between science and human needs and values. We have been very successful at creating dynamic, end-to-end partnerships among the research and service communities as well as private citizenry. UMAC's goal is to provide environmental information that helps people to make rational, informed decisions in order to improve their economic competitiveness, quality of life, and educational preparedness.



UMAC was established primarily to serve individuals and groups within Idaho, Montana, North Dakota, South Dakota, and Wyoming. Institutional connections include the Universities of Idaho, Montana, North and South Dakota, and Wyoming, State Universities of Montana, North Dakota, South Dakota, South Dakota School of Mines and Technology, Sinte Gleska University in South Dakota, and EROS Data Center. Primary user communities include farmers practicing precision agriculture, ranchers seeking optimum grazing capacities, foresters engaged in sustainable forestry, Native American land managers, and K-lifetime educators. UMAC is a distributed organization so that residents of any of the five states served have a local access node to information - or to which they can provide information. This is not an homogeneous region, but has a texture such that what is appropriate for say, northeast North Dakota, may have no relevance in southwest Idaho, or vice versa. In this way we are able to customize our applications to local peculiarities. Our engagement with end users follows a "many-to-many" model of communication whereby UMAC's team and those it serves are simultaneously students and teachers.

The USGCRP's National Assessment of the Impacts of Climate Change and Climate Variability has been an outstanding pioneer experiment in developing a societal response to a problem exposed by scientific investigation. The Assessment process has paved the way for public policies, advocated by an informed citizenry, to address environmental challenges. However, a key to developing and implementing this process is education and stakeholder involvement so that people first understand the need for policy change, and second have a voice in the specific manifestations of that change. By definition public policy addresses human needs and values.

Among the ways in which UMAC is engaged in both formal and informal education are the following components of an Environmental Information Network. Highlights include: 1) Prairie-to-Mountain Explorer, a grade 6-12 educational resource and teacher's guide for GIS, 3) periodic workshops to engage the public in a discourse about climate variability and change, 3) an informational and interactive website where we post climate data, remotely sensing imagery, environmental news, and multimedia presentations about environmental topics, 4) a public television interstitial series called "Our Changing Planet" that presents critical issues of global change at a general audience level, 5) Climate Change in Our National Parks, a project designed to raise public awareness of the specific effects that climate change is having on natural ecosystems. The underlying objectives with all EIN components and materials are to enhance scientific literacy and technical abilities as well as educate the next generation toward responsible stewardship.

PRAIRIE-TO-MOUNTAIN EXPLORER: A 6-12 EDUCATIONAL RESOURCE AND TEACHERS GUIDE

The "Prairie-to-Mountain Explorer", a grade 6-12 computer application that is available on CD-ROM, allows students access to a variety of geographical information in a user-friendly Arc-View environment. Teachers are trained at statewide workshops conducted by teachers and science educators who were previously so-trained. At the workshops they learn to integrate the GIS tools into their curricula and are introduced to ways in which spatial information can be synthesized to address local problems. Climate change issues often can be used as a focal point whereby students get involved in meeting the needs of their own communities. The students are not drawn from any one course, say Earth Sciences, but rather the PTME resources enrich both natural and social sciences, as well as mathematics.

Two levels of training for PTME occur. Weeklong "Train the Trainers" workshops are held for teacher-leader teams from each of the five UMAC states. These workshops, co-sponsored by ESRI, allow educators to develop and share advanced knowledge and skill in using GIS, GPS and remote sensing applications in the classroom. These teams, once trained, can subsequently hold in-service teacher workshops in their respective states. During the in-service training teachers also learn how to use the Internet and supporting websites to access additional data and to network with other educators. They then use these technologies and strategies in their classrooms, and extend their learning to fit the goals and objectives related to their state and local content standards. In the 1999/2000 academic year alone, 97 teachers were trained. Teachers attending an in-service workshop typically teach between 50 to 100 students each year. A conservative estimate for 1999/2000 suggests these ninety plus teachers will reach over six thousand students. The potential for 6th-12th grade students to act as change agents is great. Not only are they tomorrow's decision-makers but also, they effectively disseminate ideas and concepts they are learning in school to their homes and communities. By providing quality in-service instruction and by distributing data, which is in a "user-friendly" format and is relevant to local and regional settings, we are equipping teachers and students with effective tools they can and will use.

REGIONAL ASSESSMENT ON THE IMPACTS OF CLIMATE CHANGE: STAKEHOLDER INVOLVEMENT

The USGCRP's National Assessment of the impacts of climate variability and change has been an outstanding pioneer experiment in developing a societal response to a problem exposed by scientific investigation. The Assessment process has paved the way for public policies to address environmental ills. UMAC has been involved in this process from its inception, particularly with regard to engaging stakeholders in assessment activities. Our assessment activities revolve around 1) consolidating the present state of knowledge about the impacts of climate variability and change in our region, 2) communicating this knowledge to citizens of the region, 3) engaging their participation in determining what we are doing to the planet, 4) collectively identifying "no regrets" strategies for what we should do about it, and 5) realizing opportunities (e.g. renewable energy) that might arise as a consequence of change.

UMAC has hosted three regional workshops on climate variability and change in the northern Great Plains. Two of these were aimed toward broad audiences including producers, educators, representatives from government and industry, academics, and other concerned citizens. These workshops were held in November of 1997 and 1999 at the University of North Dakota. In addition to featuring spokespeople on key national issues the workshops included presentations by our end user community showing examples of how site-specific weather information and satellite imagery help them make resource management decisions that are both economically and environmentally beneficial. Breakout sessions engaged participants in dialogue on key climate change topics of concern for our region. Results from these two workshops were integrated into the National Assessment Synthesis Report released in 2000 and will provide a foundation for a regional summary on the impacts of climate variability and change in the northern Great Plains, which is currently in preparation.

UMAC sponsored a third workshop, called "Healing Grandmother Earth," in April 1999 in Rapid City, SD to specifically address the impacts of climate variability and change on the native peoples and homelands of our region. The workshop was organized and hosted by Sinte Gleska University of Rosebud, SD. Native Americans represent an important stakeholder community in the northern Plains and Rocky Mountains; nearly half of all existing tribal colleges are located here. For many Native Americans the impacts of climate variability and change result in an exacerbation of preexisting socio-economic and environmental problems. For example, on the Rosebud Sioux Reservation in South Dakota, the native community and their tribal leaders have been grappling with the appropriate use of land, water, and environmental resources. Today's decisions take on broader ramifications in the face of potential change scenarios such as increased frequency and intensity of extreme weather events. Participation by native peoples considerably enriched the northern Plains perspective. At the workshop many individuals expressed a deep sense of connection to the Earth and a traditional appreciation of the interconnection among all life on the planet. Native Americans have the longest climate history of any residents of North America and their environmental decision-making philosophy embodies a consequential timeframe of seven generations into the future. We believe scientists and policy makers alike have much to learn through ongoing communication with stakeholders who have relevant and practical understanding of local environmental complexities.

THE WORLD WIDE WEB: www.umac.org/OCP

The need to educate and inform people about their environment is crucial in the northern Great Plains, where small shifts in weather and climate patterns can have dramatic consequences. Through our website UMAC strives to be a source of accurate, timely environmental information for our region. We intend the information to be the basis for decisions by individuals, businesses, and society. That is, we believe people make the right decisions if given the right information. People gain climate data, environmental news, and multimedia presentations about environmental topics, all of which are continuously updated. They can also read about various UMAC projects.

As the website evolves we will incorporate more animations and visualizations. It will also increase in interactivity. We are presently focusing on enhancing our use of GIS, specifically the ability of GIS to not only display spatial patterns of various quantities, but to show how the patterns change with time. The world is essentially "transparent," any spot being covered repeatedly by fleets of satellites. The presentation of information as maps, and moving series of maps, represents an international "language" that is understood by people from different educational backgrounds.

We also anticipate building on our use of the Web as a "classroom." Because UMAC has people from 9 universities in 5 states, it requires a virtual presence. The web is the glue that holds the consortium together; it is the place where all can stay attuned to the organization that is larger than their own campus setting. Two purposes of the consortium were to acquire a critical mass of talent and to have widely diversified expertise. It is then to our advantage to use that expertise at all the institutions. We have begun to teach courses over the Web in which the instructor for a class session is the best available within UMAC and the instruction is made available to students at every other UMAC institution. For many classes presentations can be live webcasts; in all cases students can access live audio versions of the class. Interaction is facilitated via a chat session. An advantage to this kind of educational environment is in the depth and breath of expertise that can be assembled. A second advantage is in the synergistic exchange between the various individuals involved.

OUR CHANGING PLANET: A PUBLIC TELEVISION INTERSTITIAL SERIES

In coordination with the Aerospace Network at the University of North Dakota, UMAC has produced the first 10 segments of "Our Changing Planet", a public television series of 90-sec interstitial programs aimed at increasing awareness of environmental and climate change issues outside traditional classroom environments. The "mini programs" present critical issues of global change at a general audience level. Topics for the first 10 segments, which began airing on local and regional PBS stations in May 2000, are Signs of Warming, Tales Told by Trees, Island Earth, Water Water Everywhere, Fresh Water, Future Energy Supplies, Sea Level Rise, World Population, A Hole in the Ozone, and Acid Rain. OCP segments, along with supplemental information and resources on climate change issues are available on the UMAC website. Thirty-five additional programs will be distributed over the next 2 years.

CLIMATE CHANGE IN THE NATIONAL PARKS

The northern Great Plains and northern Rocky Mountains are home to many national parks, some of which are treasures for the entire world. Often the parks are the only places where natural ecosystems can be experienced. Therefore, they serve as baselines against which human-induced environmental changes can be compared. UMAC has begun an initiative to increase public understanding of the specific effects that climate change is having on the parks and other natural ecosystems. The pilot project for this initiative was undertaken in collaboration with the National Park Service and the Global Change Research Group at Glacier National Park in Montana. Because melting glaciers provide such a poignant example of global warming, this is a particularly suitable location for raising public awareness of climate change. The research group has developed a model that combines historical measurements and future temperature predictions. The simulation model displays the complete demise of glaciers in the park by 2030.

For summer 2000 a Global Change Educational Cabin has been set up near the Apgar Visitor's Center at the western entrance to the park. Materials in the cabin include posters displaying "repeat photography" of glaciers in the park over the last 80-100 years, informative brochures that demonstrate some of the ecosystem changes that accompany warming temperatures, examples of current research projects in the park, and an interactive, multi-media kiosk that demonstrates how climate change affects Glacier Park as well as the planet in general. OCP segments are available for viewing at the kiosk, as is an animation of the glacier/ecosystem model and various other materials about climate change in Glacier Park. Contacts have been made with park personnel at Theodore Roosevelt National Park to initiate a similar project there for summer season 2001.

SUMMARY

UMAC is working to bridge the gap between scientific understanding of Earth's systems and public awareness of what that understanding portends. Specifically, by providing people accurate, timely information about the Earth they are able to understand that their actions are major contributors to changes being quantified today through our global monitoring systems. This information demonstrates that the present generation is borrowing from future generations. Yet because people are well-intentioned, they can change their behaviors....and will, if provided sufficient information and given a voice in decision-making processes that affect their, and their descendents' lives. ❑

Low Snow, No Go in PNW

Philip Mote

ABSTRACT

As part of the U.S. National Assessment of the Consequences of Climate Variability and Change, the Climate Impacts Group (CIG) University of Washington (Seattle) has completed a regional integrated assessment for the Pacific Northwest (the states of Idaho, Oregon, and Washington). Following the release of the assessment report in November 1999, CIG team members had the opportunity to engage audiences around the region at a series of public events. The presentations had two main messages: first, that the main impact of climate change would be a reduction in snowpack and hence summer streamflow; second, that the region's institutions are ill-prepared to deal with a changing climate. Both messages seem to have resonated with audiences and with the region's media. ❑

Native Peoples / Native Homelands Outreach

Bob Gough

ABSTRACT

As a follow-up to the recommendations of the Native Peoples/Native Homelands Climate Workshop held in Albuquerque, several regional transboundary workshops are in the planning stages to be held this Spring through Fall of 2000, particularly along the U.S./Canadian border. These workshops will share current assessment information and seek the seasoned perspectives of America's First Peoples on the impact of climate variability and change in North America.

Native Peoples, with strong spiritual traditions and long community memories of adaptation and survival in specific regions, are likely to be the hardest hit by the impacts of a rapidly changing climate. Native Peoples are making a tremendous contribution to the assessment and understanding of climate change and the development of ecologically sustainable economies.

Through the use of interviews with Native elders, a series of radio public service-type announcements and short features are being planned as outreach and information dissemination. ❑

Session B4

PROMOTING COMMUNITY ACTION: A MUNICIPAL PERSPECTIVE

From Awareness to Action: Focussing the Climate Change Message
Chuck Wilson
City of Ottawa

A Case Study of Municipal Climate Change Outreach Strategies for the Residential Sector in the City of Ottawa
Mary Anne Strong
City of Ottawa

Integrating Climate Change Analysis Into Community Planning Using Geographic Information Systems
Richard Parfett and Ralph Torrie
R.S. Parfett & Associates; Torrie Smith Associates

Linking Air Issues: Co-Benefits as a Communication Strategy
Quentin Chiotti
Pollution Probe

From Awareness to Action: Focussing the Climate Change Message

Chuck Wilson

Efforts to raise awareness about climate change, while important, should not command the bulk of our limited communication resources. Priority must be given to proven messages and techniques which are incentives to action on climate change. Once identified for a specific client group, these incentives to action should be the focus of our communication efforts. This requires a shift in communications from a holistic climate change message towards targeted, client-oriented marketing.

INTRODUCTION

Ultimately, our collective action as citizens, corporations and governments will resolve the issue of climate change: communicating about climate change, as important as that may be, is but a means to an end. It is imperative, therefore, that the specific messages and communication techniques which lead to action on climate change become the primary focus of our efforts. As we focus our communications to facilitate action, we confront the widely-held belief that a paradigm shift in our societal attitude towards the environment is a prerequisite to resolving the issue of climate change. We are challenged to shape our climate change communications around the reverse belief - that action comes first. It is by being led into action through effective incentive that we develop a deeper understanding of climate change, through this new understanding that we may be motivated to take further actions, and because of our understanding and actions that a transformation in our societal attitude towards the environment may gradually take place.

The first section of this paper explores the assumption that people's understanding of climate change will motivate them to take action in their lives. This exploration challenges the ways in which our limited communication resources are deployed. The second section of this paper questions the effectiveness of communicating a holistic climate change message, and attempts to demonstrate that it is targeted, client-based marketing which leads people to action. The final section of this paper offers a general framework for crafting incentive-based communication materials.

Examples of climate change communication materials, from Canada's building, transportation, municipal and community sectors will be made available to session participants at the conference.

UNDERSTANDING LEADS TO ACTION: EXPLORING THE ASSUMPTION

Raising the awareness of climate change amongst Canadians is important and necessary work, and a tremendous amount of our resources are directed towards this end (Pollara, 1998. Climate Change Secretariat, 1998). This is done, in part, on the assumption that if citizens are made more aware of climate change, they will be motivated to take mitigating action in their lives. This assumption must be explored fully, because there is mounting front-line evidence that an awareness of climate change is not, in fact, a major incentive to action. If this proves to be the case, it does not mean that we should cease our efforts at communicating about climate change altogether. It would imply, however, that our limited communication resources be redeployed towards those things which are proven to catalyse action on climate change, particularly at the local level.

A questionnaire was circulated to delegates prior to this conference to sample our understanding of the issue of climate change. A modified version of this questionnaire was distributed to a limited number of colleagues at the City of Ottawa in an attempt to explore the link between our understanding of climate change and concrete action. While not a statistically valid sample, the 16 respondents represent an interesting cross section of society: engineers, secretaries, students, tradespeople, computer technicians and environmentalists. All responses were submitted anonymously.

Participants were first asked to rate their understanding of climate change using the conference questionnaire. The results indicate that this group has a strong understanding of the issue:

- 72% have known about climate change for 6 - 10 years;
- 78% felt certain that climate change will occur;
- 86% believed that human-induced climate change was occurring and that we should be very concerned about;
- 86% also correctly identified at least three major causes of climate change.

This same group was then asked about certain actions in their lives which have an impact on climate change. Their responses are summarized in Table 1.

Results indicate that the majority of respondents - despite a strong understanding of climate change - always drive to work, never use public transit for errands or intra-city travel and always use their clothes dryer. This challenges us to ask whether the actions of these respondents would be modified in a meaningful way by having an even greater understanding of climate change.

The inference drawn from this limited poll - that understanding climate change is not a prerequisite for action - is supported in the results of another, more substantial, staff survey.

In June, 1999 the City of Ottawa polled those employees who had taken part in the *Commuter Challenge*, a week-long campaign to promote alternative and active means of getting to work such as cycling, walking and taking transit (Commuter Challenge, 2000). Of the 74 survey respondents: the majority considered themselves to have a firm understanding of transportation and climate change issues, 68% indicated that they were regular "green" commuters, and 97% welcomed the opportunity to participate in future environmental events.

Staff participants were asked to identify the main factor which motivated them to participate in the Commuter Challenge. The single most popular response to this question (32%) was: "the chance to win prizes". Next, at 30%, were those who replied that they were motivated to act because of "the chance to make a positive environmental contribution". Respondents were also invited to provide written feedback, in which 20% made reference to the environment or climate change. Of the remaining comments, 40% raised issues relating to ease of program participation, and 40% focussed on the prizes. In short, most people took action because of a chance to win a prize, and well less than half of a motivated, educated cohort were drawn to participate in the event

TABLE 1: Survey Respondent's Lifestyle Choices

	Never	Some Times	Always
I drive to work in the morning	22%	28%	50%
I take public transit when running errands*	100%		
I take the train or bus for travel between cities	65%	28%	7%
I hang my laundry on a clothesline to dry	50%	15%	35%

* Ottawa's transit system is ranked as one of the best in North America.

because of their understanding of environmental issues [These results do not include, of course, those who chose not to respond to the poll nor the 1,200 staff who chose not to participate in the *Commuter Challenge*.]

These results helped the City to redesign the *Commuter Challenge* communications for the year 2000 campaign. An awareness of climate change was not considered to be a major incentive for staff participation, and therefore did not feature heavily in the promotion of the event. Communications focussed instead on the prizes being offered and the straightforward method of registering in the campaign. The year 2000 Commuter Challenge was the most successful environmental event ever held among City staff, with a record participation rate despite a 70% decrease in campaign resources from1999 levels.

These results do not suggest that we should cease all communication efforts to raise awareness of climate change. They do, however, challenge us to ask whether awareness campaigns about climate change are an effective use of communication resources, particularly at a local level. Individuals do not seem drawn to participate in events because of a heightened understanding of the link between their actions and climate change. In reality, the reverse may be true: in a poll, 51% of City respondents indicated that participating in the *Commuter Challenge* had made them more aware of transportation and climate change issues. By first participating because of other incentives, we gain a deeper understanding of the issue of climate change and our role in it. This understanding may then motivate us to take even further action.

FROM CLIMATE CHANGE COMPLEXITY TO TARGETED MESSAGE

Through the work of the national Issues Tables, a complete set of climate change action measures have been identified for each sector of the Canadian economy (Climate Change Secretariat, 2000). Many of the incentives and the barriers to implementing these measures are documented, and they continue to be clarified through dialogue with individuals and corporations in every sector. It is these specific incentives and barriers to action - *not climate change* - which must become our central message as we craft communication materials around a given measure. In so doing, we will replace holistic messages about climate change with targeted marketing techniques in order to catalyse widespread action on climate change.

One organization which is focussing its communication messages and techniques in this way is the Ontario Green Communities Association (GCA). The CGA is a coalition of a dozen environmental non-profit organizations in towns across Ontario. Since 1994, the GCA's objective has been to facilitate energy reduction, water conservation, urban greening and other environmental initiatives within their local community, primarily through a home visit service.

As early as 1994, the GCA began to conduct regular surveys in an effort to identify the barriers and incentives to action among their clients. By 1998, at least ten surveys had been conducted from among the 15,000 households in the GCA client base, the most extensive being a direct call survey of 400 home visit clients in Toronto in 1998 which attempted to identify incentives and barriers to implementing home retrofit measures. The survey results indicate that:

- only 1% - 5% of clients identified the environment as the reason which motivated them to proceed with a home visit service. Clients identified home comfort (drafts, cold rooms) and high utility costs as the key reasons which prompted them to get the service.
- 49% of clients identified a reluctance to trust contractors as the reason they had not proceeded with substantive home retrofits.
- 71% of clients also identified the quality assurance of the service, the simplicity of booking the service, the need for direct referrals to contractors and other transaction costs as barriers to implementing home retrofits.

In 1998, the Toronto office of the GCA, Green$aver, began to target its communication materials around these client concerns, moving from promotional materials aimed at raising environmental awareness among homeowners to materials which targeted the incentives and barriers raised in the client surveys. Marketing techniques were also altered: communication materials accompanied monthly utility bills in an effort to reach those with high bill concerns, and television appearances were made on home repair shows to appeal to those thinking about renovations or home upgrades. The home visit service was also standardized across the province, and modified to address the transaction barriers identified by the clients (Green$aver, 2000).

A comparison of two of Green$aver's early communications campaigns with similar budget and layout are included in Table 2 below. Samples of these two initiatives will be distributed to session participants at the conference.

As the Toronto office moved away from holistic communication materials, focussing instead on responding to client incentives, the result was an increase in home visits and environmental benefits. This trend continues across the province. In the 1998 fiscal year the GCA delivered a total of 800 standardized home visits in Ontario, with a potential for 3,440 tonnes in eCO_2 reductions. Through a continuous modification of the home service and a shift to targeted marketing materials, the GCA conducted 2,718 visits in fiscal 1999, with a potential for 11,687 tonnes in eCO_2 reductions (Green Communities Association, 2000).

This change in communication techniques has been, and continues to be, a challenge for the GCA. Staff with training and experience in holistic community promotions have had to adjust to the more restricted, linear communication techniques of client-based target marketing. Nonetheless, the progress made by the GCA between fiscal 1998 and 1999 represents a 340% increase in environmental effectiveness, and reflects the GCA communications belief that: "Traditionally, it has been assumed that people must be educated about environmental issues before they will be motivated to take action. The Green Communities approach is the reverse: action comes first, and people become educated about issues in the process. As a result, they become motivated to take further action."(GCA News 223, 2000).

A GENERAL FRAMEWORK FOR INCENTIVE-BASED COMMUNICATIONS

There are several developmental differences between communications designed to "raise awareness" of an issue, and client-driven marketing. The holistic message of climate change is appropriate for the former, but this message must be replaced with specific barriers and incentives if it is to lead to meaningful action. It should also

TABLE 2: Green$aver Communications Comparison

	1997 Promotional Flyer	1998 Promotional Flyer
Distribution	20,000 direct mail	10,000 utility bill inserts
Text	850 words, 6 graphics	80 words, 1 graphic
Themes	summary of service elements description of house as system description of client report range of financial savings water retrofit cost and contents description of all service elements assessor qualifications explained	home comfort financial savings (healthy indoor air quality)
Results	10 home visits booked	35 home visits booked
Climate Results*	1 tonne annual eCO_2 reduction	7 tonnes annual eCO_2 reduction

* calculations based on GCA eCO_2 estimates

be noted that effective communication is not something that happens in a vacuum. Our communication efforts must be tied to and built around a program or set of measures if we intend to facilitate action. Therefore, our choice of communication techniques and messages will be dictated somewhat by the actions and programs which they are designed to support. The following is a general framework which can be used as a guide in designing and comparing incentive-based climate change communication materials.

1. Identify the Client and the Climate Change Action Measure(s):
The National Climate Change Secretariat has established 18 Issues Tables covering all sectors of the Canadian economy. The Table participants have, in turn, identified dozens of sub-sectors and hundreds of climate change measure categories. The more specific we can be in choosing a client and climate change measure(s) from these lists, the greater the likelihood that we will design targeted, effective communication materials. Our choice of client and the measures to be targeted will naturally depend on our profession, location, program objectives, and so forth.

Example Client:
Commercial building owners in the City of Ottawa with buildings exceeding 100,000 square feet, including multi-unit apartments.

Example Measures:
Heating / Lighting / Ventilation / Air Conditioning improvements, lighting and control upgrades, building envelope air sealing, new windows.

2. Identify the Client Incentive(s) and Barrier(s) to Action:
Many incentives and barriers to action have been documented by the Issues Tables, and there is an ongoing need to revisit these through polls surveys and dialogue with the client. Our success in identifying the relevant incentives and barriers to action is directly related to how specific we have been in selecting our client. For instance, the motivating factors for large commercial building owners differ greatly from those faced by building owners with retail space, industry, or small-scale rental properties. The incentives and barriers specific to our client should become the focus of our communication efforts.

Example Incentives:
Retention of current tenants; attracting new tenants; no out-of-pocket expenses.

Example Barriers:
High transaction cost to implement retrofit; lack of in-house mechanical expertise; high turnover rate in building ownership.

3. Establish a Communication Objective:
This is a critical step, and one that is often overlooked. The intent is to establish, if possible, measurable objectives by which to track the effectiveness of our communication effort. Often, this will relate to or support a measurable program objective. Only by tracking our effectiveness can we revise and improve our communication messages and techniques.

Example Objectives:
(Communication): Generate 30 calls, e-mails or other contacts from interested C/I building owners in the City of Ottawa by autumn, 2000.

(Related Program): Initiate retrofits in more than five local C/I buildings, resulting in annual eCO_2 reductions of at least 1,700 tonnes.

4. Restrict the Communication Messaging to Relevant Incentives and Barriers:
This is a challenging step, and often an act of discipline, as we develop messages which do not feature a holistic climate change message, but focus instead on the incentives and barriers to action identified in step number 2. If time and resources permit, it is of tremendous value to test communication materials with a sample of the target clientele prior to a full campaign.

5. Deliver and Support the Communication Materials in a Professional Way
With respect to communication materials, the medium is the message, and professional delivery is essential to success as much as the quality of the content. Once again, this is also true of the accompanying program delivery and content. A more extensive "how-to" approach to targeted communications can be found in the work of social marketing theorists (ex: McKenzie-Mohr, 1999), and much can be gained by simply engaging mainstream advertising professionals in the issue of climate change.

Table 3 on the following page compares two different communication campaigns on climate change. Samples of these communication materials will be distributed to participants at the conference. Despite repeated calls to their office, no statistics were available regarding the print budget, circulation or the number of survey responses generated by the Environment Canada publication. There is also no record of action on climate change resulting from this flyer. By contrast, the OC Transpo pilot communications campaign will achieve a measurable reduction in eCO_2 when fully implemented, with a print budget of less than $1,500.

TABLE 3: Environment Canada / OC Transpo Communications Comparison

	Action 21: Canada's Transportation Challenge	RMOC: OC Transpo EcoPass
1. Client	Canadian public	Regional staff U of Ottawa staff
2. Client Incentive(s)	unknown	convenience savings
3. Communication Objective	raise awareness about climate change and transportation feedback from public	sell 200 EcoPasses
4. Messaging	climate change smog human health effects transportation costs infrastructure costs peak travel times demand planning urban communities transportation alternatives the role of personal choice individual solutions corporate solutions	convenience savings (environment)
5. Develop and Test	unknown	pilot
6. Tracking Success	unknown	376 pass holders / 4,500 flyers. Can track eCO2.

CONCLUSION

Our communication efforts must be directed towards facilitating action on climate change. An understanding of climate change is not a prerequisite, nor a motivating factor, for this action to occur. Individuals and corporations are motivated to act based on specific incentives and these, rather than a holistic message of climate change, should be the focus of our communication efforts. By first engaging in meaningful action, we are drawn to deeper understanding of climate change and may be inspired to take further action in our communities. The sum of our collective actions will resolve the issue of climate change, and may transform the way in which we relate to our environment. ❑

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A Case Study of Municipal Climate Change Outreach Strategies for the Residential Sector in the City of Ottawa

Mary Anne Strong

The City of Ottawa is one of many cities in Canada and around the world that have made commitments to reducing greenhouse gas (GHG) emissions within their communities. To achieve their objective of a 20% reduction in GHG emissions from 1990 levels, it is necessary to engage local citizens in actions, which can have a measurable impact on emissions. This paper illustrates how climate change communication directed at the residential sector has evolved since 1995. Early outreach programs approached the issue as a global climate change problem with minor consideration of the local benefits of climate change action. More recent programs promote saving money and home comfort through energy efficiency. Climate change mitigation is now presented as an additional benefit to taking action, rather than being the primary focus of communication. This approach has the potential to reach a much broader audience than outreach strategies that focus on communicating the single issue of global climate change.

INTRODUCTION

Climate change is caused by multiple individual daily actions as residents select housing, transportation and consume energy within the context of choices that exist in their communities. Municipal governments in Canada are uniquely positioned to address the issue of climate change and greenhouse gas emission (GHG) reductions. As the closest level of government to the people, and a major factor in local economies, municipalities can affect GHG emissions through: regulations, by-laws, as a facilitator, partner, delivery mechanism and educator. Effective communication is an essential element for municipal governments intent on motivating the public to take action on climate change.

While it is necessary to consider the local context of GHG emission sources, knowledge of the experiences of other groups engaged in promoting community action will enhance local programs. To date, there has been little documentation of the strategies used by municipalities to reduce local emissions, nor effective sharing of public outreach strategies. This paper presents a case study of the City of Ottawa's community outreach initiatives targeting the residential sector. The City has established an aggressive goal of a 20% reduction in community GHG emissions (below 1990 levels) and is now midway to the target year of 2005. The City's baseline GHG inventory established that the residential sector accounts for approximately 30% of the City's emissions, thus the success of community outreach strategies in this sector will be crucial to achieving their goals.

The purpose of this paper is to illustrate how the City of Ottawa's climate change communication has evolved from early problem-focused campaigns to recent more solutions-oriented approaches. This paper illustrates various outreach programs established for the City of Ottawa's residential sector. The first section provides background on the issue of climate change, response strategies and outlines effective outreach and communication methods. The second section describes and analyzes the range of tools used to reach households within the City of Ottawa. It assesses how the problem is defined, how messages are framed and evaluates the solutions presented.

BACKGROUND

Climate change has emerged as a significant global political issue in recent years. Although there has been considerable debate over the extent to which human actions are affecting climate, there is now consensus among leading scientists that anthropogenic GHG emissions will lead to a global rise in temperature of 1E to 3.5EC by 2100, and other climate disturbances. Increasing CO_2 emissions, resulting primarily from the combustion of fossil fuels and land use changes are responsible for the majority of elevated atmospheric CO_2 levels which enhance the earth's natural greenhouse effect (IPCC, 1991).

The anticipated effects of climate change are highly variable, some regions and economic sectors will benefit while others sectors will encounter significant adverse impacts. Positive impacts could include a warmer winter climate in northern regions and longer growing seasons, which may increase agricultural potential in northern latitudes. Adverse impacts include: sea level rise and the potential flooding of vast coastal areas inhabited by humans; agricultural disruptions due to shifting rainfall and drought patterns; increasing climate instability and intensity; and human health impacts due to the northward spread of tropical disease (Paterson, 1996, IPCC, 1991).

In response to the threat of climate change, formal negotiations commenced towards an international treaty on climate change in February 1991. These negotiations led to the signing of the "Framework Convention on Climate Change" (FCCC) at the United Nations Conference on Environment and Development (UNCED) in June 1992. The 154 nations, including Canada, which signed the FCCC, committed to a voluntary target of stabilizing greenhouse gas emissions at 1990 levels by the year 2000. In ensuing years it had become evident that most nations would not achieve this target. In December 1997, 160 nations, including Canada, negotiated a new international protocol in Kyoto, Japan. This agreement commits Canada to reducing its greenhouse gas emissions by six per cent below 1990 levels between 2008 to 2012 (IISD, 1998).

At the same time that environmental research and policy development has been intensive at international and federal levels, hundreds of municipal governments around the world, including 60 Canadian municipalities, have made commitments to local GHG emission reductions. Municipalities engaged in climate change action commit to achieving absolute reductions of GHG emissions within their corporate facilities and functions and within their communities. Corporate achievements can help to demonstrate leadership as the municipality seeks to engage the community in measurable GHG reduction initiatives. Canadian cities such as Toronto, Vancouver, Edmonton, Regina and Ottawa have all made commitments to reducing GHG emissions by 20% below 1990 levels by 2005. Focussing attention on reducing GHG emissions produced in large Canadian cities is important due to the fact that 75% of Canada's population lives in urban areas (Government of Canada, 2000). If community-based greenhouse gas reduction strategies prove effective, associated decreases in emissions within these cities could have a significant positive impact on Canada's Kyoto commitment in addition to providing many community co-benefits.

Co-benefits and the Importance of Scale

Climate change is a global atmospheric phenomenon and the potential impacts are often communicated on the same scale. Global average temperature increases, sea level rise, global average precipitation and evaporation changes, and shifts to global atmospheric circulation are examples of potential global-scale changes. While climate change is a global-scale problem, the costs and benefits associated with action or inaction are temporally and spatially differentiated, distributed unevenly between countries, within regions and across generations (Chiotti, 1998).

Due to the global nature of climate change, the literature provides relatively few clear linkages between climate change and other air issues. This may be the result of the different scales from which atmospheric issues are approached and analysed. Climate change is perceived and addressed as a global problem that requires global solutions. Other air issues, such as smog and acid rain are considered regional and local issues, and are therefore addressed at national, regional and local scales. Recent climate change literature is beginning to address the issue of the multiple benefits of reducing GHG emissions on local and regional scales. Reducing CO_2 emissions through reduced fossil fuel use is seen to have the additional benefit of achieving reductions in other air emissions such as sulphur dioxide, nitrogen oxide, particulate matter and ozone (Chiotti, 1998, Last et al. 1998). Many of these pollutants are precursors to other atmospheric problems such as acid rain and smog, all of which are known to have damaging effects on the environment and human health. Municipalities engaged in climate protection have realised that benefits from actions to reduce GHG related emissions will therefore accrue in the near term and in regions where mitigation occurs- their own communities (Government of Canada, 2000).

The co-benefits of local climate change action extend beyond a reduction in conventional air pollution. For example, as part of their commitment to reduce GHG emissions, municipalities such as Toronto and Ottawa have developed programs to enhance the energy efficiency of buildings within their communities. The City of Ottawa has implemented a comprehensive energy efficiency retrofit program for its own facilities which has substantially reduced building utility costs through a 17% reduction in energy use since 1990 (City of Ottawa, 1999). Toronto's community-wide building retrofit program, the *Better Buildings Partnership* (BBP) has created an estimated 3,000 jobs, reduced annual building operating costs by over $6 million, and reduced Toronto's GHG emissions by 72,000 tonnes of CO_2 (BBP, 2000). These communities have found that reducing local emissions through actions aimed at reducing energy use also creates substantial local economic benefits. These examples run counter to fossil fuel industry arguments of potential economic disaster should Canada act to curtail emissions.

Framing the Issue

The relationship between the way environmental problems are labelled and defined is an important factor in determining the range of response strategies available. For example, whether global warming is defined as a warming issue, or as an energy or fossil fuel combustion issue will determine the range of available responses (Fiorino, 1995). Policy makers defining problems in visible terms can respond with technical fixes such as scrubbers on power plants and catalytic converters, rather than with energy efficiency measures, transportation controls or other comprehensive strategies (ibid.).

To date, the international debate has defined climate change as a warming problem and the focus of global response strategies has been on reducing overall global warming potential. Framing the climate change issue as a global problem has led many governments to believe that mitigation should be done on a global level. For example, some nations' mitigation efforts may be in the form of joint implementation, which focuses on reducing or sequestering GHG emissions in developing nations. Defining climate change as an energy, or fossil fuel use issue may have evoked very different response strategies. If all climate change mitigation is sent over-seas, countries taking the global approach to climate change mitigation will continue to struggle with the local and regional impacts of fossil fuel use, such as smog and acid rain. Making the links between global air issues and closely related local and regional issues will be essential to providing effective strategies that can achieve multiple benefits at all scales. When evaluating municipal outreach, this paper will assess the extent to which climate change is presented as a unidimensional, global warming problem or whether links are being made to other associated issues and the local co-benefits of climate change mitigation.

PUBLIC INFORMATION CAMPAIGNS

Education to promote voluntary action is a key thrust of current response strategies in Canada. It is seen as a necessary first step to motivating citizens to act and to foster public support for broader policy and regulatory changes that, in the long term, may have a substantial impact on behaviour (Government of Canada, 1998). The application of information and education approaches to environmental problems is relatively straightforward (Gardner and Stern, 1996). For example, outreach material describes the nature and severity of the problem in an effort to convince the public that action on their part is essential. Information programs then describe specific actions that individuals can take to solve the problem. Most programs developed to alter behaviour rely heavily on large scale information campaigns which attempt to alter behaviour through media advertising, brochures, flyers and news-letters (McKenzie-Mohr, 1996). This approach is used for many important issues such as seatbelt safety, smoking and drug awareness campaigns.

Information is considered an essential first step to overcoming external barriers to individual action such as ignorance and misinformation (Gardner and Stern, 1996, McKenzie-Mohr, 1996). If people do not know which of their daily actions are most responsible for energy use and emissions, they cannot act on a desire to make a difference. However, although they are considered an essential first step to public action, research clearly indicates that information campaigns by themselves rarely lead to desired behavioural changes (ibid.). Studies demonstrate that there is very little relationship between attitudes, knowledge and behaviour. While positive attitudes are conducive to action, they are only predictive of action under certain conditions. Information is most effective when barriers to action are low (i.e. inexpensive, convenient). Behavioural changes are much more likely when strong barriers to action are removed. Barriers are higher when actions are inconvenient, complex or expensive. Providing information to change attitudes combined with the removal or reduction of external barriers has the potential to be more effective than traditional information intensive campaigns (ibid.).

Knowledge of the barriers associated with behaviour change and programs targeted at reducing specific barriers are identified as key components of outreach programs and as such, they are essential to developing effective municipal GHG emission reduction strategies. Uncovering barriers to action is considered to be a critical first step to any outreach program, though it is most often over-looked. Reasons for skipping this stage include time constraints, cost and assumptions that barriers are already known. Barrier identification may add to the cost of a program, but the additional costs may be minimal compared to re-designing a program that was ineffective because it was based on incorrect assumptions. There are three common strategies to uncovering barriers: literature reviews, focus groups and surveys (McKenzie-Mohr, 1996).

Selecting the Behaviour to Change

Carefully choosing the behaviour to change is of fundamental importance to achieving the desired result. Quantitative and technical information can more clearly direct one to behaviours that have the greatest impact on a given problem (Gardner and Stern, 1996). In Canada, there exists a wide body of research that outlines the primary case of elevated GHG emissions in each sector. In addition, each municipality that develops a community action plan is required to complete a detailed analysis of their local GHG emission profile. This allows communities to target their programs based on local emission profiles, which can differ greatly from community to community.

While the residential sector is an important component of national GHG emission reduction strategies, it is even more important for a city like Ottawa. The City's residential sector accounted for 30% of 1990 GHG emissions (City of Ottawa, 1995), while nationally the residential sector accounts for just over 17% of energy-related GHG emissions. In Canada, space and water heating account for 82% of total energy consumption in this sector (61% and 21% respectively). Lighting accounts for 4%, appliances 13%, and cooling 1% (Government of Canada, 1998). To ensure maximum emission reductions in this sector, municipal communication strategies should ensure that residents understand the impact of the range of energy efficiency choices available.

Communicating Solutions:

The literature suggests that there are considerable benefits to distinguishing between one-time (or infrequent) energy efficiency actions and repetitive, curtailment activities. Curtailment activities include actions such as cutting down the number of car trips, switching off lights and turning down thermostats. Curtailment actions require on-going effort on the part of the individual to continue saving energy and may lead to a decrease in comfort levels, which may lead to a feeling of personal sacrifice (ibid.). Energy efficiency can be achieved by purchasing and maintaining more fuel-efficient vehicles and appliances. Energy efficient behaviours tend to be one time or very infrequent actions that do not generally involve lifestyle changes. Research indicates that though Canadians are concerned about the environment, they are not keen to make major shifts in their every day lives (Cheney, 1998), thus promoting energy efficiency actions may gain wider public acceptance.

If no clear distinction is made between the relative benefits of curtailment actions versus energy efficiency, the public may select minor curtailment activities instead of the changes that have the most impact. Studies have demonstrated that the average householder often believes (incorrectly) that they can save twice as much money by reducing lighting use as by using less hot water. In addition, householders are generally unaware of the technical options available for saving energy, especially modifications to heating systems (Stern and Aronson, 1984). In Canada's residential sector, lighting accounts for only 4% of GHG emissions and turning off unnecessary lights can reduce this by 18%. Outreach which promotes switching off lights should identify this action as a minor contribution to energy efficiency compared to the potential for large emission reductions through space heating improvements. For example, it is estimated that GHG emissions from space heating (61% of residential energy use) could be reduced by 38% if high efficiency equipment is added and building insulation is improved (Government of Canada, 1998). Information campaigns that do not provide a ranking of the most effective energy conserving strategies may run the risk of leading interested consumers to select a less energy saving option. The result could be a demoralized consumer with reduced incentive for additional effort (Stern and Aronson, 1984). Communication strategies need to ensure that the public is provided with information that can lead them to select the actions that will have the largest impact on emissions.

The previous sections illustrate the need to carefully define the problem to be addressed, illustrate the benefits of local action and the need to differentiate between energy efficiency actions and curtailment behaviours. Other elements of successful public outreach strategies, which must be considered when developing municipal GHG emission reduction programs, include:

- keep the message simple, visual, and personally relevant;
- provide balanced perspectives on problems and solutions;
- avoid scare tactics or pleas for sacrifice;
- use multiple approaches, media, local agents;
- promote consistent reinforcing messages;
- provide feedback, reminders and prompts and elicit a public commitment
- Build in a method for evaluating program effectiveness (Environment Canada, 1998).

Municipalities that have developed action plans establish a record of total emissions from the residential sector. However, subtle changes in behaviour associated with a specific program will not show up in aggregate numbers, thus the need to build in a method for evaluating the effectiveness of community outreach strategy will be essential for municipal programs. Often this is achieved through the use of surveys, although measuring direct behavioural changes is preferable (McKenzie-Mohr, 1996).

CITY OF OTTAWA CASE STUDY

In August 1992, Ottawa City Council passed a resolution committing itself to a 20% reduction in the City's CO_2 emissions by the year 2005 (based on 1990 levels). In October 1995 "A Call to Action: the City of Ottawa's Task Force on the Atmosphere Action Plan" was completed to help the City and its residents achieve their greenhouse gas emission reduction target. This program is midway to its target date and programs have been implemented to engage the community in GHG emissions reductions.

Though the Action Plan was developed in response to the City's climate change commitment, the issue has been framed more broadly and is presented as a local economic development opportunity, and a quality of life issue. The document states that "The Task Force has realised that reducing CO_2, mostly through increasing energy efficiency, not only makes sense environmentally, but economically as well." (City of Ottawa, 1995, Pg. 2). The report also asserts a commitment to implementing solutions, which will contribute to the overall reduction of CO_2, as well as other harmful air emissions, with the emphasis on providing a cleaner and healthier environment for City of Ottawa residents.

The initial Action Plan also clearly identifies the most important measure to achieve its GHG emissions reduction goal, energy efficiency. While the original action plan clearly linked local co-benefits to global climate change solutions, the initial public communication strategy focused much more on the problem of global warming. Outreach strategies have evolved over time and the problem of climate change has now become a minor component of the City's recent solution-oriented response strategies.

1995 Residential Outreach

An early example of climate change outreach material illustrates the extent to which the problem was initially presented as a single, global issue. A four-page public information brochure presents the issue of climate change as follows:

- Experts Predict Global Warming: Greenhouse Gases blamed;
- City of Ottawa Sets targets for Greenhouse Gas Reductions;
- Individuals can help fight global warming.

The pamphlet then explains the issue of global warming, the global impacts and its key causes. It illustrates the per capita influence that Canadians and local residents have on global GHG emissions, and identifies energy use through the burning of fossil fuels as a key contributor. In this case, global warming is the problem to be solved; the co-benefits of local action are a relatively minor component of the brochure's focus and are identified briefly as "fringe benefits". The material does not provide any discussion of the local impacts of global warming, nor the additional negative effects of energy use such as air pollution. Research suggests that messages that are personally relevant and which portray imminent local impacts, rather than distant, global effects will be more effective (Cheney, 1998, Environment Canada, 1998). Thus, a message with clearer identification of potential local and individual impacts may have had more weight than the message provided in Ottawa's first outreach pamphlet.

After two pages of defining the problem and causes of global warming, solutions are then presented. The solutions identified include both curtailment and energy efficiency actions. The information includes estimates of the impact of each behaviour change on CO_2 emissions and fuel use. For example, it states that driving an efficient vehicle can cut emissions by 50% over the life of a car and that maintaining proper tire inflation can save 5% in fuel costs. In addition, it encourages the purchase of energy efficient appliances and furnaces. Reduced CO_2 emissions are the focus of the pamphlet, with minor reference being made to other benefits such as cost savings through reduced fuel use, parking and vehicle operating costs.

This first outreach document was distributed through information kiosks at public libraries, shopping centres and community centres. The back of the form invites feedback from the public regarding the City's climate change strategy. However, there is no documentation available to determine the extent of feedback received from this program, nor is there any means of quantifying its impact. Contrary to recommended practice from the literature, there is no evidence that public surveys were undertaken to establish a baseline level of awareness, therefore, it is difficult to determine the uptake or resulting emission reductions from this outreach program.

1997 Information and Referral Service (IRS)

The City's second major public communication strategy was the establishment of a public information and referral service. The objective of the information and referral service (IRS) is to provide information to community members interested in undertaking energy efficient investments. The stated assumption behind the IRS is that sufficient economic incentive already exists to undertake residential energy efficiency measures during building design, construction and renovation and that what is lacking is good, timely, information from a credible source. It was anticipated that by providing citizens with useful, concise information at the right time, lost opportunities to implement energy efficiency measures would be avoided and providing citizens with useful, concise information at the right time could maximize potential GHG emissions reductions.

To achieve the objectives of the IRS, the City of Ottawa developed the Ottawa Green Information Line (OGIL). OGIL is a menu driven telephone system developed to provide a central location for information on energy efficiency for City residents. The system provides information on a wide variety of topics such as new home construction, renovation, the home office, heating, cooling, lighting, transportation and waste. The OGIL, which is part of the City's Meridian phone system, has been in place since September 1997. Since its launch, the

OGIL has been marketed using brochures, refrigerator magnets and business cards.

The OGIL denotes a shift in the City's approach to framing and communicating the climate change issue, from a central focus on global warming and CO_2 emission reductions, to a focus on economic incentives and energy efficiency. Promotional material is positive and solutions- oriented promoting energy savings at your fingertips with a strong emphasis on saving money. Information presented provides clear examples of energy efficiency versus curtailment actions. For example, new home purchasers are directed to purchase an energy efficient R-2000 home for the improved re-sale value and reduced energy costs. Reducing GHG emissions is presented as an additional benefit to improving energy efficiency.

As recommended in the literature, the City also established a means of monitoring the OGIL which records the number of phone calls and the number of information trees visited by each caller. However, there was no mechanism to ensure that the information provided was used, thus no measurable GHG emissions reductions could be linked to the program. Results demonstrate that OGIL has not achieved high uptake levels. For example, in 1999 there were a total of 160 calls to the line, and of those, only 62 individuals progressed beyond the initial greeting. Many of the information items provided by the OGIL received no visits.

Clearly, this program is not reaching a sufficient number of residents to produce a significant increase in citizen awareness and action on energy efficiency and climate change. This system has very good information, though if only a few are using it, then measurable GHG emissions reductions will not be achieved. A possible reason for the failure of this program could be a lack of investment prior to program development to determine the barriers to energy efficiency within the community. Initial research to identify barriers may have indicated that a menu-driven telephone information system was not appropriate response strategy. The City is now moving away from broad-scale information campaigns to more targeted approaches to achieve emission reductions in the residential sector.

1999 Home Energy Rating Systems

In 1999 the City helped to establish EnviroCentre, an independent not-for-profit enterprise, to reduce emissions in the residential sector. EnviroCentre is supported by corporate and government partners including the City of Ottawa. The cornerstone of EnviroCentre's service is *EnerGuide for Houses (EGH)*, a residential energy assessment tool designed by Natural Resources Canada (NRCan). A qualified evaluator visits a home and assesses its energy-related features and provides an energy efficiency rating, much like the EnerGuide rating seen on appliances.

The resulting Energy Assessment Report provides a detailed description of each measure homeowners can undertake to improve the efficiency of their home. The effect of energy efficiency measures are clearly illustrated and differentiated from more minor changes associated with curtailment behaviours. For example, one report indicates that the assessed home's existing space heating equipment is consuming 81% of the energy use in the home, lights and appliances account for 8% and hot water, 10%. Recommended improvements to the heating system are very specific, providing advice on adjusting dampers to installing a high efficiency furnace. Cost estimates for each action are provided as well as potential annual utility bill savings. In this case the service also indicated that the home had inadequate indoor ventilation and recommended immediate remedial action for health reasons. The report also states that the homeowner could save over $670 per year in energy costs should all recommended actions be undertaken. This very personalised approach conforms to existing literature recommendations, which indicates that messages must be personally relevant.

Although *EGH* is identified as an important component of the City's climate change strategy, it is marketed as a home comfort/ air quality assessment, a renovation guide and a contractor quality assurance support. The fact that GHG emissions will be reduced as a result of home improvements is seen to be incidental to homeowners and as such, the climate change message is presented as a co-benefit to purchasing this program. Thus, rather than communicating climate change, the City of Ottawa is focussed on communicating home comfort and energy efficiency solutions to the population.

Community newspapers are used as an important way to target specific areas such as older neighbourhoods where homes are prime candidates for energy retrofits. A recent community newspaper article presents a positive message of home comfort and energy savings while noting that energy efficiency can also mitigate climate change. This approach conforms to proven methods that demonstrate that the message needs to provide a personal connection, focussed on positive solutions and multiple benefits (Environment Canada, 1998). A detailed local success story is provided to illustrate results achieved within the target community. This approach is endorsed by research that demonstrates that high profile success stories, showing solutions in action, are elements of successful campaigns (ibid.). Other tools identified for disseminating information on EGH include holding seminars at local renovation stores; mass mailings in utility bills and City permit applications and forming partnerships with contractors, builders, co-ops and condominium boards to market bulk EGH sales.

This program has many of the elements of a successful grassroots campaign. Research indicates that learning and change happen most effectively when the message is one-on-one such as with home energy audits, or with presenters working with local community groups (Environment Canada, 1998). EnviroCentre has elements of both of these success factors including direct homeowner contact with the EGH assessor and planned presentations to local groups. The literature also indicates that messages are most successful when the same information is conveyed many times and is conveyed from a variety of sources. EnviroCentre's use of multiple media including local and regional newspapers provides a variety of sources. The establishment of a credible NGO voice has also been identified in the literature as an important vehicle for delivering the message (ibid.). EnviroCentre is a not-for-profit environmental NGO, which can deliver the message to the community while demonstrating the support of other levels of government and the private sector in its outreach campaigns

Compared to earlier broad-based approaches to climate change communication this program has the additional benefit of providing measurable emissions reductions to track program effectiveness. A free follow-up assessment will measure the energy reductions achieved once clients have implemented the measures recommended in their report. This can demonstrate the effectiveness of energy efficiency measures for the benefit of both program staff and homeowners. When homeowners request an EGH through EnviroCentre, an initial survey provides information on the existing home and asks the homeowner to identify their primary motivating factor for requesting the service. Anecdotal evidence suggests that the primary motivation for obtaining an EGH is to save money, home comfort concerns are a close second, followed by environmental and health concerns (Silk, 2000). This suggests that communication should continue to target the key message of saving money and home comfort and that environmental welfare can continue to be addressed as a beneficial co-benefit.

CONCLUSION

This paper has identified some of the key elements of successful strategies to communicate climate change solutions to the public. It has illustrated that the way in which a problem is defined affects response strategies and the messages presented. The City of Ottawa's residential outreach has evolved considerably over the years. Initial outreach material focussed on the problem of global warming and the need for individuals to reduce GHG emissions, with little reference to the co-benefits of local action. The second approach, OGIL, provided information that emphasised the key solutions to climate change and provided economic arguments to promote energy efficiency. Though the information was good, the means selected to disseminate the information proved ineffective. A key reason for the low program uptake could be that an important first step in effective communication planning was missed. Initial research to identify the barriers to energy efficiency within the target audience may have resulted in a more effective program. In addition, neither of theses programs had the ability to document measurable GHG emission reductions, which are essential to achieving the City's 20% emission reduction target.

The most recent residential outreach strategy promotes individualised home energy audits. Communication focuses on the economic and home comfort benefits of energy efficiency, and the fact that the measures promoted also can contribute to reducing climate change impacts and improving local air quality are identified as minor co-benefits. This approach runs contrary to many current approaches that assume that individuals must first be aware of climate change and its impacts prior to taking action. In fact, when program forms ask for the homeowners' primary motivating factor for selecting a home energy assessment, the environment ranks behind saving money and home comfort. In fact, homeowners do not need to be aware of, or concerned about climate change to be motivated to act. Therefore, this program has the capacity to reach a much broader audience than communication strategies that focus only on solving the global climate change issue. Adding a climate change connection within the communication material ensures that individuals who are concerned about climate change will know that their actions are making a difference. In addition, individuals who do not make the connection between home energy use and GHG emissions will be educated about the links, whether or not it motivates them to act.

The residential sector is broader than the homeowner market currently targeted by EnviroCentre. It would be beneficial to explore the use of home energy assessments and energy efficiency programs to target low income housing to ensure that these residents have knowledge of, and access to efficiency measures that will save them money. In this case, it is anticipated that climate change mitigation will be incidental to householders concerned about reducing the cost of their utilities. These solution and results-oriented approaches mark the direction that municipal outreach programs will need to take to motivate residents to act and to achieve their community GHG emission reduction targets. ☐

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Integrating Climate Change Analysis Into Community Planning Using Geographic Information Systems

Richard Parfett and Ralph Torrie

This paper describes the results of the development of Geographic Information System-based model of City of Ottawa. This GIS model integrates transportation data, land use information, building energy consumption data from electric and gas utilities, and demographic information. This model can be used as a research tool to provide insights into the interrelationships between transportation and land use planning, demographic and geographic factors within individual communities. Planners can also use it as a tool to create alternative land-use and transportation planning and policy scenarios where the greenhouse gas emissions impacts are clearly shown and can be easily communicated to decision-makers and the public.

THE CONTEXT – COMMUNITIES AS ENERGY USING SYSTEMS

The greeenhouse gases that are causing global warming are mainly the result of fossil fuel combustion and much of the discussion over how we can reduce these emissions centres around the potential for more energy efficienct technologies. In this paper, we look beyond energy technologies in the narrow sense of the term, and consider how the energy system itself is shaped by and shapes communities. Communities are not just places where one finds a concentration of energy use; they are themselves intricate energy using systems. Like any other more conventional "energy technology", the amount of energy a community uses and the amount of environmental damage it causes depends on how it is designed, how it is built, and how it is used. What makes the concept of "the community as energy technology" so interesting is that the community system includes every energy using device within it, all the connections and potential connections between those devices, and all the infrastructure that connects the community to the fuel and electricity supply lines on which it depends for its survival and prosperity.

While it is obvious that the modern Canadian community has been absolutely shaped in every way by the universal availability of very large concentrations of fuel and electricity, it is not so obvious what are the deeper causal relationships between community form, spatial structure and the energy system. Most post-War communities in Canada exhibit a combination of low density and high levels of land use segregation that result in high levels of automobile dependency and energy intensity and low and declining public transit feasibility. We know from international comparisons that cities with similar climates and levels of economic well-being have vastly different energy intensities depending on how well the community design supports district energy, combined heat and power, and reduced need for mobility by private automobile. Overall energy intensity can vary by a factor of three or more depending on the energy efficiency of the community system and on the capturing of synergistic opportunities between the energy using and producing components within the community.

The level and pattern of the demand for end use energy in the community will be affected by investments, policies and practices with regard to buildings, population densities, water supply, sewage collection and treatment, waste management, tree planting activity, the size and location of parklands, land use zoning, parking, transit, roadways, traffic management, property taxes, urban redensification, policing, pedestrian and cycling infrastructure, even economic and industrial development policies. Local governments are especially important agents in this regard, with over 50% of Canada's greenhouse gas emissions falling under the direct or indirect control and influence of local government policies, regulations and investments.

This paper starts from the premise that a better understanding of how we build energy intensity into the design and operation of our communities will help us to identify techniques and technologies for reducing that energy intensity and its related environmental footprint. There is a dearth of quantitative, analytical techniques, or even simple mapping and visualization tools, to support energy efficient and environmentally sustainable community planning. The crude modeling techniques that are available for estimating the potential for reduced energy intensity through community design suggest a 17-30% reduction in overall energy use could be achieved through community energy management, and international comparisons indicate the potential could be much greater.

GEOGRAPHIC INFORMATION SYSTEMS AND CLIMATE CHANGE ANALYSIS

Geographic Information Systems (GIS) offer a powerful framework for organizing, visualizing and analyzing the relations between the numerous factors that affect the level of energy use and greenhouse gas emissions in the community. Communities are made up of components that have specific forms and functions, and the spatial relationships between the components go a long way to explaining such important determinants of greenhouse gas emissions as mobility requirements, automobile dependency, and the potential for district and solar energy technologies. Geographic Information Systems provide a visual representation of the community as an energy consuming and greenhouse gas emitting system. GIS can do this by tying diverse data sets to geographic location.

A community's form has a multitude of dimensions. There is the physical structure, which comprises roads, sidewalks, sewers, water mains, wires, buildings and vehicles. But there is also a spatial and cultural component to urban form. Roads are laid out in a pattern that can vary from one part of the community to another. Rivers, parks, open spaces, ecologically sensitive areas, cultural and civic buildings are all unique and uniquely located in relation to one another in each and every community. The function of built form, which is the way in which, for example, areas of the city are zoned to restrict the way in which buildings are used also has a spatial and cultural component. For example, North American cities typically segregate building use into low-density residential, commercial or industrial use. All communities have "neighbourhoods" which have specific demographic and cultural characteristics that influence the nature of local shops and services provided and patterns of mobility. While some cultural elements that influence building function are present in many communities, other elements of urban function are unique to each community. All these factors are part of community form and function and will influence the way in which infrastructure is laid out and used. Community form and function have a profound influence on energy consumption and consequent greenhouse gas emissions. Any attempt to develop cross-community prescriptive land-use or transportation related measures to reduce urban greenhouse gas emissions is likely to meet with limited success due to the unique nature of each community. Therefore, it is argued here that there is a need to develop a tool that allows planners to understand and appreciate the unique nature of cities, their neighbourhoods and the way in which energy is being consumed to provide services to their residents. The understanding of a community's unique form and function will allow planners to determine the most effective ways of reducing greenhouse gas emissions.

Not only does culture influence community form and function, but form and function may also influence culture. If residents are offered low-density residential developments devoid of local employment, services and efficient public transportation, they will choose a car-oriented way of life out of necessity. Urban dwellers may not be able to conceive of alternatives, or recognize the value of alternative urban form and function if they have no experience of how it will affect their lives. If shown how community form and function influences their lifestyle choices, and if shown how changes to community form and function could improve access to employment, services and public transit, save traveling time, reduce urban air pollution and money spent on energy, it is possible that more residents would choose an alternatives that are less automobile dependent and less energy intensive.

In our research into the application of GIS to the problem of energy efficient and environmentally sustainable community planning, we are attempting to develop a GIS-based analytical framework that will not only identify relations between diverse types of information but provide a basis for supporting scenario and "what if" analysis of how Canadian communities could be made both more liveable and environmentally sustainable.

THE CITY OF OTTAWA CLIMATE CHANGE GIS PROJECT

The GIS system we are currently developing for the City of Ottawa ties together:

- Statistics Canada demographic and socio-economic data
- Local government zoning and land use maps, traffic and travel survey databases, road and transit infrastructure maps (including detailed street network), natural features maps, etc.
- Detailed fuel and electricity consumption information from local utilities

All data is georeferenced and can be displayed for common geographic units. In addition to providing information on trip origins and destinations, the trip making information also includes data on mode (automobile, public transit, school bus, taxi, walking, bicycling), number of vehicle occupants, trip purpose, and time of trip. Trip lengths are calculated and, together with information on mode, the energy required to make the trip is calculated. The trip making and building energy consumption information can be converted into greenhouse gas emissions in order to quantify emissions resulting from specific activities, such as non-work related trip making by traffic zone (a transportation planning construct that is on average about two square kilometres in size, but size varies based on population density). The result is a map that can display information related to urban form, local geography and culture, and demographics. This information can then be linked to observed transportation patterns, energy consumption and greenhouse gas emissions throughout the community.

Transportation-related Greenhouse Gas Emissions

This type of GIS system is an analytical tool that can be used to understand not only where emissions are occurring, but more importantly, why. In addition, differences in land-use, geography, demographics or other variables can be linked to observed changes in energy use and emissions. For example, in the GIS tool developed for the City of Ottawa, the average distance travelled by residents of each traffic zone for non-work related trips was modeled (see Figure 1). Non-work trips are trips to daycare, entertainment, school and shopping. By modelling non-work trips, it is possible to see the degree of "self-containment" of an area – meaning how many of the required services are located within or close by a neighbourhood. This is important because trips to work during rush hour in Ottawa represent only about one-third of all trips made on an average weekday and 50% of greenhouse gases emitted. Factoring in weekend trips, non-work trips become the dominant trip-making activities and the greatest producers of transportation-related greenhouse gas emissions even though they are generally shorter in length than trips to work.

The results show a general pattern that is typical of most North American cities. Neighbourhoods developed in the pre-1945 period have a higher degree of self-containment than neighbourhoods built in the post-war period. As one moves further from the downtown core, self-containment begins to break down. Pre-1945 neighbourhood streets have a grid-like pattern, housing densities are higher and services and employment are provided on a main street that cuts through the middle of the community and is generally within easy walking distance. Post-1945 developments are built around the car. Streets are curvilinear, services and employment are further away and not easily accessible by foot. Even if one were to attempt walking to the store, there are no sidewalks and the distance to the store is lengthened by the curvilinear streets and cul-de-sacs. These and other problems with post-war suburban development are well documented elsewhere. The more interesting observation from this modelling exercise is that there are some clear exceptions to the general pattern.

The specific reasons why some zones have considerably higher trip lengths than others will require some detailed analysis of each zone. One might expect that zones with high incomes and/or high densities would have a wealth of services available to them, as the densities and income could support the shops and other services. However, it is clear from a preliminary analysis that density of development and income do correlate with trip lengths, but not well enough to be considered primary explanatory variables. One zone in particular (Zone 80) appears to show how the geography of a city can serve as an important factor in explaining trip-making behaviour. This zone is bounded on one side by the Rideau River and on another side by Highway 417. These two physical features serve as barriers to access for residents of this zone, forcing them to travel further to access services and, it would appear, to use their cars to access those services. The net result is that average non-work trip lengths are 50-150% greater for residents of this zone than for residents of neighbouring zones.

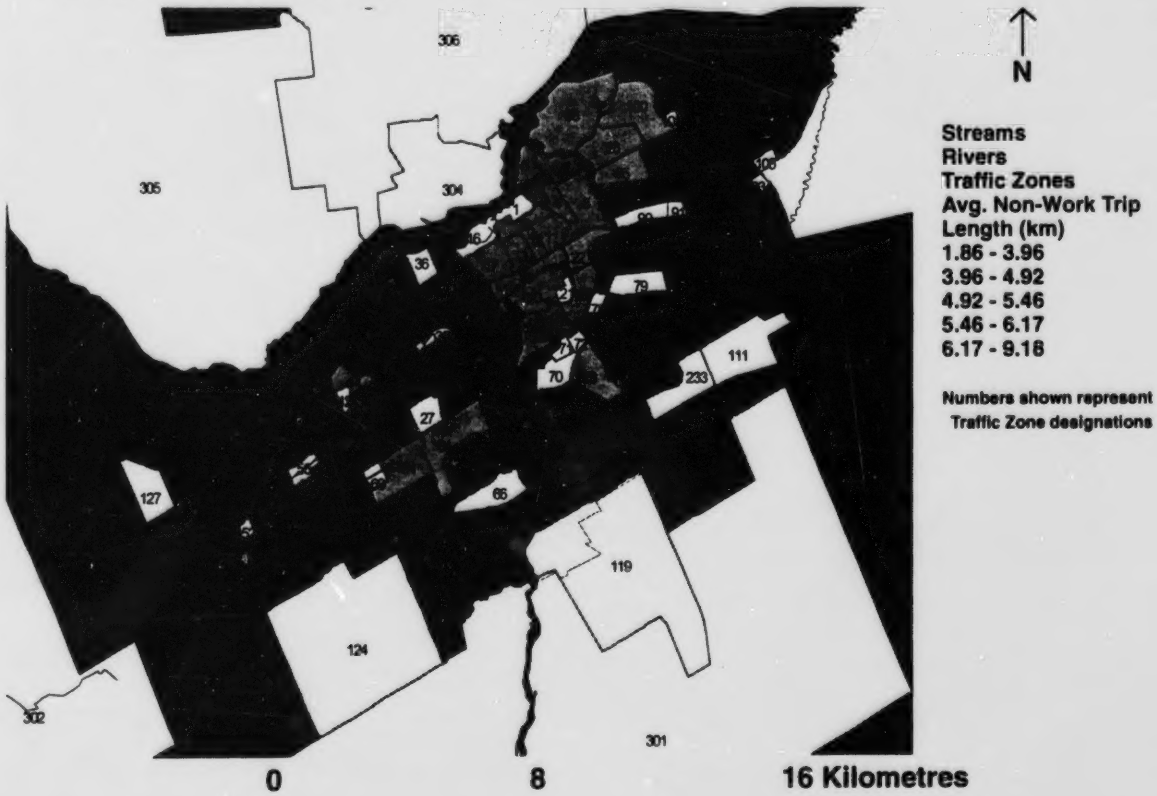
What appears to be the best explanatory variable for both length of non-work trip and modal choice is access. Zones with good access to shops and other services tend to have the lowest average trip distances and the lowest average greenhouse gas emissions per trip (a reflection of modal choice, as emissions per trip declines as use of auto alternatives such as public transit, walking and cycling) (see Figure 2). Outside the downtown core, some of the zones with excellent access to services include 44, 61, 64, 73, 92, 94, 103 and 125. While access appears to be reducing non-work trip length for most of these zones, it does not correlate well with non-work trip length for zones 92, 94 and 103. Clearly, the specific trip-making, demographic, land-use and other characteristics of each zone must be investigated to better understand what other factors are at work in explaining trip making. There are clearly a number of variables at work that make it difficult to draw any broad conclusions or to assume that what works for one zone or one community will work for another community. However, non-work trip lengths and greenhouse gas emissions from non-work trips are varying within the city by up to a factor of three, which serves as a indication that significant greenhouse gas emissions reductions from finding ways to reduce non-work trip lengths are possible.

Building-related Greenhouse Gas Emissions

There are three ways of reducing greenhouse gas emissions from buildings:

1. Reduce the energy requirements of buildings through energy efficiency upgrades;

FIGURE 1:
Average Non-Work Trip Lengths by Traffic Zone, City of Ottawa


306
305
304
1
16
36
79
108
111
233
70
27
127
66
119
124
302
301
N
Streams
Rivers
Traffic Zones
Avg. Non-Work Trip Length (km)
1.86 - 3.96
3.96 - 4.92
4.92 - 5.46
5.46 - 6.17
6.17 - 9.18
Numbers shown represent Traffic Zone designations
0
8
16 Kilometres

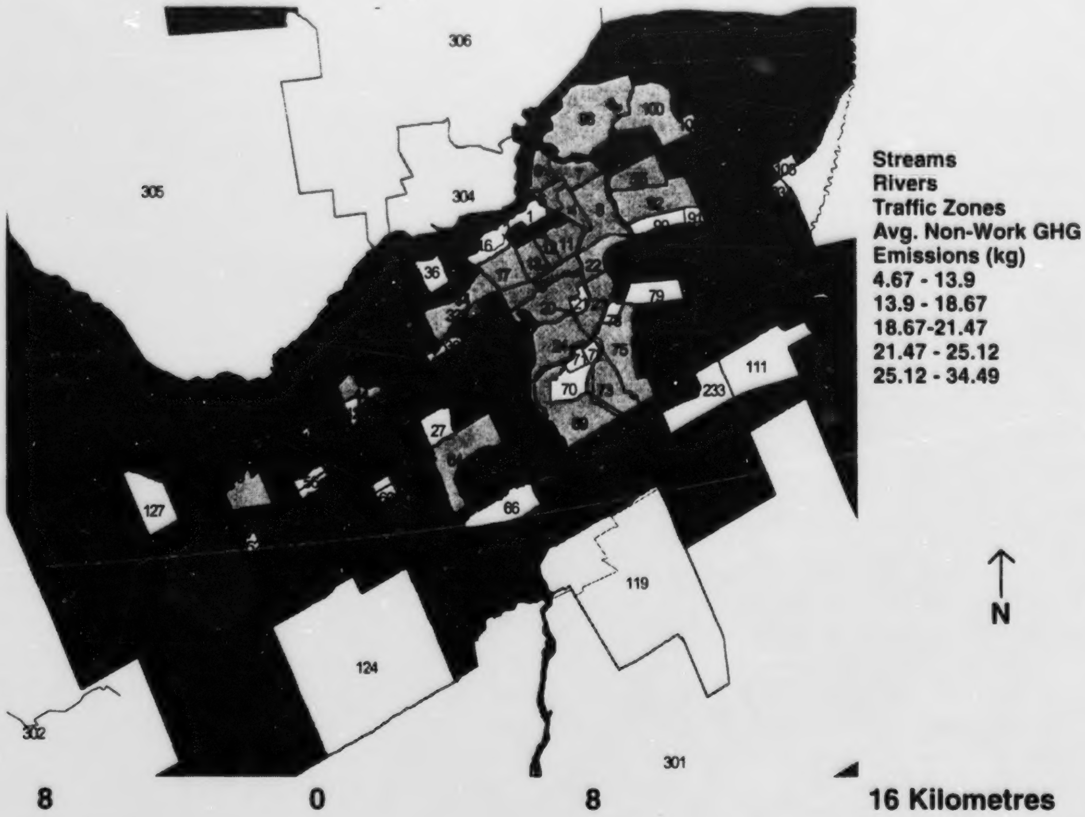


FIGURE 2:
Average Non-Work Greenhouse Gas Emissions by Traffic Zone, City of Ottawa

2. Switch from high greenhouse gas producing fuels, such as electricity made from coal to low greenhouse gas producing fuels, such as natural gas; and
3. Connect buildings to district energy systems

Developing active building energy efficiency upgrade programs should always be the first option chosen to reduce building emissions because it is generally most cost-effective. Fuel switching is a good option for homes or businesses that use electric space or water heating in communities where the electricity comes primarily from central power plants that burn coal or oil. Geographic Information Systems can be used to link databases that provide information on building energy consumption (from gas and electric utility account information) and databases that provide information on building vintage and floor area by geocoding records based on postal codes. A single database providing these basic statistics can be used to determine whether a building has higher than optimal intensities of energy use and therefore would be a candidate for a building energy efficiency improvement program. The degree to which building greenhouse gas emissions could be reduced can also be determined, which helps municipal planners determine the usefulness and cost-effectiveness of such a program in achieving municipal emissions reduction targets.

The true power of GIS for reducing building-related greenhouse gas emissions lies in the ability to identify candidate areas for district energy systems. District energy systems provide heat, electricity and in some cases cooling from a central plant which distributes the energy to surrounding buildings. The source of energy can be standard fuels such as natural gas, bio-waste such as municipal solid waste or wood waste if a local supply is available, or waste process heat from a commercial, institutional or industrial facility. District energy systems can also use deep lake or river water as a cooling energy source. In general, these facilities can significantly increase the efficiency with which fuel is used in a community to produce heat and electricity (district energy systems convert about 60% of their input fuel energy into heat and electricity, whereas a typical thermal electric generating plants converts about 35% of fuel energy into electricity). In most cases, to make a district energy system feasible, a sufficient "heat load" is required to make the system cost-effective. This means that a mix of industrial, commercial and residential buildings within reasonable proximity to one another is optimal. Due to the 20th century propensity for segregating land-use in urban areas, district energy systems are not viable for many neighbourhoods. However, some existing urban areas would serve as good candidates for district energy systems and, if a community is experiencing growth, new developments can be built with district energy systems in mind. GIS serves two important functions in studying the feasibility of district energy:

1. GIS can be used to identify areas with potential sources of waste energy such as industrial, institutional or commercial facilities; and
2. GIS can be used to determine whether sufficient heat load exists to make a district energy system cost-effective.

This is done by examining both existing land-use (where are hospitals, universities and industrial facilities that could serve as waste heat sources located) and building energy consumption. In order to be a good candidate for district energy, a sufficient heat load must exist within a given radius of the proposed district energy plant. In neighbourhoods that do not have commercial, institutional or industrial facilities that would serve as sources of waste heat, but that do have sufficient concentrations of heat energy use, local land-uses may permit the construction of a district energy plant. The systematic analysis required to determine district energy feasibility in both existing and new developments can be done very effectively using GIS. The net result could be large reductions in overall community greenhouse gas emissions.

DEVELOPING GREENHOUSE GAS REDUCTION SCENARIOS

Ultimately, once an understanding has developed as to how and why different parts of a community are producing greenhouse gas emissions, it is possible to begin developing "what if" scenarios where policies are implemented to reduce those emissions. These policies should have as their goals reducing the need for mobility, increasing access to auto alternatives, identifying buildings in need of energy efficiency retrofits or fuel switching initiatives, identifying neighbourhoods that could serve as candidates for district energy systems, and building new neighbourhoods with all of these goals in mind at the outset. Reducing the need for mobility can involve assisting major employers in developing telework programs, ride-sharing or vanpool van programs. The GIS system can be used to identify employers that have large numbers of employees utilizing single occupancy automobiles to go to and from work. The greenhouse gas emissions from these trips can be readily quantified and the emissions reductions benefits of programs estimated. These employers can then be approached to develop appropriate automobile travel reduction programs.

Where it is clear that improved access to services would reduce non-work related trips, zoning amendments could be made to permit mixed-use development in a neighbourhood that would include daycare, shopping, entertainment or other services. Changes in travel behaviour would have to be estimated, but assuming the estimates are reasonable, the greenhouse gas reductions from such policies could be estimated.

Large-scale changes to transportation infrastructure, such as road widenings, extensions or transit infrastructure extensions may require the use of transportation modelling software such as EMME/2 in addition to the GIS model. The anticipated changes in passenger kilometres travelled along different networks resulting from new infrastructure is something that the GIS program cannot do effectively. However, iterative analyses involving transportation modelling software and the GIS program can provide planners with the required information to effectively model the greenhouse gas emissions impact of such initiatives.

The goal of developing scenario analyses is to determine what policies will most likely reduce greenhouse gas emissions as effectively and cost-efficiently as possible. The end result is a series of measures with their anticipated greenhouse gas emissions impacts quantified that will achieve the community's overall greenhouse gas emissions reduction target.

CONCLUSIONS

Land-use and transportation planning are rarely done interactively with the goal of reducing trip-making, encouraging auto alternatives or improving transportation and building related greenhouse gas emissions. Public transit planning is handled by transit authorities, transportation planning is handled by transportation engineers and building energy consumption is not a municipal planning responsibility. This compartmentalization of community planning leads to higher community greenhouse gas emissions by not looking for synergies between the community system and the community energy system. The myriad of additional community benefits that can accrue from planning alternatives designed to reduce greenhouse gas emissions can make developing such alternatives very attractive to decision-makers and the public. Lower infrastructure costs, improved air quality and mobility would likely have wide community appeal. Reducing greenhouse gas emissions will require "buy-in" from planners, decision-makers and the public. But all of these players rarely if ever have the opportunity to understand how community design influences their quality of life. Showing these stakeholders show changes in community design or in transportation policy could directly benefit them would help achieve the necessary buy-in to effect changes in local zoning or other potentially less popular measures such as parking restrictions or new capital expenditures on public transit. GIS is a useful analytical and visualization tool that allows stakeholders to see their community in a familiar way and to help them imagine alternatives to the status quo in a fashion that charts and graphs cannot do. As such, it is a valuable new climate change communication tool. ❑

Linking Air Issues: Co-Benefits as a Communication Strategy

Quentin Chiotti

The discourse on the costs of climate change has focused predominantly upon the costs of mitigation actions to reduce greenhouse gas emissions relative to those associated with climate change impacts (otherwise known as the costs of inaction). In recent years, however, this debate has been broadened to include the co-benefits for environment and health that could occur with reductions in greenhouse gas plus related emissions, specifically emissions of air pollutants which contribute to stratospheric ozone depletion, acid deposition, ground-level ozone, particulate matter, and hazardous airborne pollutants. This paper draws upon the report The Relative Magnitude of the Impacts and Effects of Greenhouse Gas – Related Emission Reductions *that was prepared for Environment Canada, and outlines the relative importance of co-benefits for environment and health in Canada's climate change national implementation strategy. Co-benefits may be the most important message that should be communicated to Canadians, in terms of generating an effective mitigation response. A conceptual model is presented, which situates the benefits for human health from reductions in criteria air contaminants (CAC's) within a broader set of benefits for ecosystems, environment and social welfare. Preliminary evidence suggests that the relative magnitude of these benefits could be significant for specific regions across Canada. The paper concludes by emphasizing the need for regional scale analysis, and outlines a pathway forward for such an assessment.*

INTRODUCTION

The development of an effective national implementation strategy for climate change represents a significant challenge to the signatories of the Kyoto Protocol, including Canada. At their December 11-12, 1997 meeting, for example, Canada's First Ministers discussed the Kyoto Protocol and agreed, among other things, that the development of an effective national implementation strategy required:

> a thorough understanding of the impact, the cost and the benefits of the Protocol's implementation and of the various implementation options open to Canada.[1]

Acknowledging the need to address both costs and benefits together represents a significant evolution in the discourse on climate change, which throughout much of the 1990's focused predominantly upon either the costs of mitigation actions to reduce greenhouse gas emissions or those associated with climate change impacts (otherwise known as the costs of inaction).[2]

In selecting from the various response strategies presented by 16 national issues tables in the fall of 1999, policy- and decision-makers are now being well advised to consider the full welfare implications of abatement measures. Many actions that slow the accumulation of greenhouse gases (GHG) in the atmosphere will also generate a wide range of co-benefits, through reductions in other air pollutants, such as sulphur dioxide (SO_2), nitrogen oxides (NO_x), carbon monoxide (CO), volatile organic compounds (VOCs), particulate matter (PM), ground-level ozone (O_3), heavy metals and other toxic pollutants. These pollutants are linked to other atmospheric stresses such as stratospheric ozone depletion (leading to UV-B increases), acid deposition, and air quality, which are known to have a wide range of adverse impacts upon aquatic and terrestrial ecosystems, as well as effects upon environmental and human health. Drawing upon the report *The Relative Magnitude of the Impacts and*

Effects of GHG – Related Emission Reductions prepared by Pollution Probe and Rainmakers Environmental Group for Environment Canada[3], this paper demonstrates the importance of linking air issues and co-benefits for environment and health, as part of an effective communication strategy that addresses climate change.

BACKGROUND AND CONTEXT

The primary source of GHG emissions in Canada are fossil fuels, which also account for about 55% of SO_2, 90% of NO_X, 55% of VOCs and 90% of CO.[4] Presently, due to technological limitations, the most cost-effective method of reducing energy generated GHG emissions is through actions to reduce fossil fuel combustion. This includes energy conservation, energy efficiency, changes in agricultural practices, and fuel switching, amongst others. However, the size of the benefits resulting from reductions in GHGs plus related emissions depends upon many factors, including the nature of the actions taken, the magnitude and duration of exposure to specific pollutants, and the sensitivity of the exposed population. Interactions among air pollutants and atmospheric issues, and the processes shaping the environmental impacts and health effects, will also influence the magnitude of co-benefits. Undoubtedly, some actions to reduce GHG plus related emissions will generate synergistic or additive relationships, while others will be counteractive in their effect, if not lead to non-linear or unexpected outcomes. Consequently, understanding, let alone estimating, the potential benefits from reducing GHG plus related emissions presents a huge challenge to policy- and decision-makers, especially at the national scale and for a country with such a large land mass as Canada.

The literature that directly addresses the issue of co-benefits from GHG plus related emission reductions consists of a small, but growing, number of studies.[5] Avoided human health effects are the most dominant areas of concern, although some studies attempt to address a wider range of co-benefits, albeit with varying degrees of scope and depth. Most studies of GHG plus related emission reductions suggest that co-benefits can be significant, yet estimates vary considerably in the literature, due largely to uncertainties and limitations of the data assessed, and differences in assumptions and methodologies employed. Consequently, there are wide variations in estimates of co-benefits, making national (and in some cases regional) comparisons difficult. Spatial aspects can also be extremely important in developing estimates of impacts and effects. Regions or countries that are dependent upon coal-fired electricity, for example, will generate a much larger amount of air pollutants contributing to regional air quality, compared to areas where hydroelectricity dominates. Similarly, rural regions with low population densities may experience much smaller levels of health benefits compared to highly populated urban areas.

ESTIMATES OF CO-BENEFITS

Not surprisingly, the value of benefits or avoided damages that have been projected in many studies are also extremely variable. In a review of co-benefit studies for the Intergovernmental Panel on Climate Change, it was discovered that the value of avoided damages range from US$2 to US$500 per tonne of carbon reduced.[6] No doubt few policy makers would be comfortable with making difficult mitigation decisions based upon such a wide range in the value of estimated benefits. Nonetheless, there is general agreement in the literature to suggest that on average the value of co-benefits would offset at least 30% of the initial abatement costs of GHG emission reductions, although in some cases savings could be much higher. For example, it has been estimated that co-benefits could offset between 30-50% of the initial abatement costs in Norway[7], and over 100% in the UK[8] and Japan.[9] Unfortunately, for Canada, estimates of co-benefits are relatively few, limited in scope, and cursory at best.[10] Most of these studies have attempted to estimate reductions in fossil fuel related emissions that would occur as a result of implementing various measures to reduce GHG, with only one recent study attempting to estimate or value the environmental impacts and human health effects. In the latter case, the report is clearly identified as preliminary, and may be more significant for raising the profile of the issue, rather than for the actual numbers presented. This represents a rather large knowledge gap in our understanding of co-benefits in Canada, and makes economic analyses of GHG control strategies difficult.

In the absence of any credible estimates of co-benefits in Canada, an Environment and Health Impacts subgroup of the Analysis and Modelling Group is undertaking a comprehensive analysis of co-benefits, as part of the

Climate Change National Implementation Strategy. This includes a complex quantitative modelling exercise, involving a multi-tiered set of 5 distinct but interconnected activities:

- the integration of the GHG emission inventory into the national criteria air contaminant emissions inventory dataa base system (RDISII);
- the augmentation of the AERCo$t model and data base to include GHG emission reduction strategies, and to incorporate quantitative estimates of the cross-pollutant impacts associated with these strategies;
- the inclusion of future GHG emission reductions and CAC reductions into Environment Canada's Emissions Forecasting Model (EFM);
- the modification of the Unified Model for Air quality to quantify the impact on local and regional air quality of measures chosen for Canada's National Implementation Plan on Climate Change; and
- an assessment of the benefits of reductions in conventional air pollutants arising from GHG emission reduction initiatives using the Air Quality Valuation Model (AQVM).

While the results from these analyses are expected to generate much improved estimates that can be used to shape public policy, history suggests that quantitative values will likely be perceived by stakeholders as contentious.[11] This could possibly lead to difficulties in securing stakeholder buy-on, confusing the general public, and slowing down the implementation of policy. All of these highlight the importance of having an effective communication strategy in place.

PATHWAY FORWARD

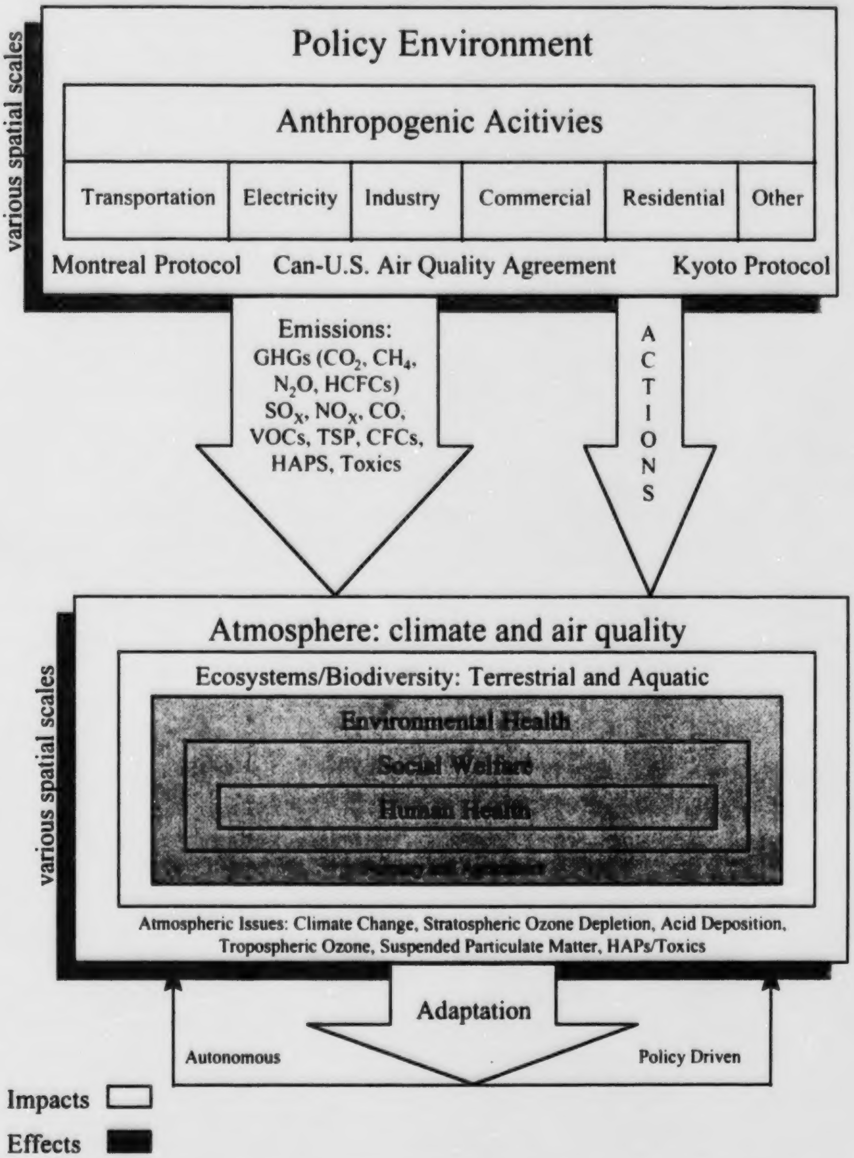
Although there are many complexities and uncertainties associated with the co-benefits issue, there are also compelling reasons to adopt the "precautionary principle" and implement a more immediate no-regrets response. On a global scale, it is important to recognize that Canada's share of GHG emissions is only 2.1%[12], so domestic mitigation efforts will have limited impact on slowing down climate change. Even if all of the signatories of the Kyoto Protocol achieve their targets (which is highly unlikely to occur), such reductions in GHG emissions will only delay a doubling of CO_2 by 20 years.[13] Further, for the United States, it is estimated that 85% of it's Kyoto target could be met via off-shore emission trading[14], which would result in little relief for regions of Canada where upwards of 50% of their air pollutants originate from south of the border. In eastern Canada, for example, the benefits of a 50% reduction in the emissions contributing to acid deposition could be 40 times greater with U.S. participation, relative to Canada acting alone.[15]

On a regional and local scale perspective, we know that SO_2 and NO_X are precursors for acid deposition, which has recently been estimated to put 20-30 million hectares of Canada's forests, 890,000 hectares of lakes in the southeastern Boreal region, and 162,000 fish populations at risk.[16] SO_2 and O_3 can cause foliar damage in crops and trees, with the latter known to reduce agricultural yields.[17] PM and secondary pollutants such as sulphates and nitrates are especially hazardous to human health, impairing both respiratory and cardiovascular systems. It has been estimated that over 16,000 annual premature deaths in Canada can be attributed to air pollution[18], while 1,800 annual premature deaths in Ontario has been attributed to PM.[19] Pollutants are also known to impair visibility and damage materials, accelerating the decay of infrastructure (roads and bridges), buildings, statues and monuments.[20]

In response to this knowledge gap, Pollution Probe and Rainmakers Environmental Group have prepared an overview scoping document for Environment Canada.[21] Intended to provide a science assessment of the current state-of-knowledge, the report also outlines an assessment framework from which to evaluate co-benefits from actions to reduce GHG plus related emissions (Figure 1). Extending beyond the basic approach adopted in most of the co-benefits research conducted to date, this assessment framework:

- Extends the range of pollutants to include pollutants that relate to all atmospheric issues.
- Considers interactions between air pollutants and atmospheric issues, including potential additive, synergistic

FIGURE 1: A CO-BENEFITS ASSESSMENT FRAMEWORK


various spatial scales
Policy Environment
Anthropogenic Acitivies
Transportation
Electricity
Industry
Commercial
Residential
Other
Montreal Protocol
Can-U.S. Air Quality Agreement
Kyoto Protocol
Emissions: GHGs (CO_2, CH_4, N_2O, HCFCs) SO_X, NO_X, CO, VOCs, TSP, CFCs, HAPS, Toxics
ACTIONS
Atmosphere: climate and air quality
various spatial scales
Ecosystems/Biodiversity: Terrestrial and Aquatic
Environmental Health
Social Welfare
Human Health
Forestry and Agriculture
Atmospheric Issues: Climate Change, Stratospheric Ozone Depletion, Acid Deposition, Tropospheric Ozone, Suspended Particulate Matter, HAPs/Toxics
Adaptation
Autonomous
Policy Driven
Impacts ☐
Effects ■

or counteractive relationships.

- Examines emission reductions, impacts and effects in relation to present air issue targets.
- Evaluates impacts on the atmosphere and ecosystems (terrestrial and aquatic).
- Determines the effects on the environment (agriculture and forestry), social welfare and human health.
- Addresses impacts and effects from the actions themselves, which are not directly related to emissions of air pollutants (e.g. reduced traffic fatalities resulting from a shift from single occupant vehicles to public transit).

By applying this framework to assess the co-benefits for Canada that could result from reductions in GHG plus related emissions, three key conclusions result. First, the overall magnitude of benefits will be greater than previously estimated. Second, the relative magnitude of non-health impacts and effects will be greater than previously estimated. Third, there is a significant need for regional-scale assessments of co-benefits, both from a qualitative and quantitative perspective.

Future work on co-benefits should address (i) uncertainties in the interactions between atmospheric issues and their synergistic, antagonistic and cumulative impacts and effects; (ii) the valuation of these benefits, particularly those for ecosystems, the environment and social welfare; and (iii) the non-emission related benefits from the actions themselves. In pursuing these knowledge gaps, it is also advisable to recognize the importance of scale in shaping co-benefits. Atmospheric issues operate at various spatial and temporal scales, but those pertaining to air quality are largely immediate and regionally specific. This is also true for benefits that will occur from the actions themselves to reduce GHG-related emissions. An integrated-qualitative approach that draws upon expert judgement to assess co-benefits may be the most practical and productive method to overcome these uncertainties and knowledge gaps. Consequently, Global Change Strategic Initiatives, Pollution Probe and Rainmakers Environmental Group, in collaboration with Environment Canada and other partners, are undertaking a qualitative assessment that will:

- Focus on estimating impacts and effects on ecosystems, environment, social welfare, human health and the actions themselves to reduce GHG-related emissions, and assigning relative values to these benefits.
- Assess the GHG options proposed by the respective Issues Tables in terms of co-benefits, and prepare a qualitative analysis.

In addition, Pollution Probe is seeking appropriate funders and partners to:

- Simultaneously undertake this assessment at an urban-centred regional scale, where the methodology can be further refined and important lessons learned.
- Situate this regional assessment within a national context and identify other regions in Canada where similar assessments should be implemented.

But what region in Canada should be the focus of such an assessment? Arguably, the Toronto-Niagara region is the most appropriate place in Canada to assess co-benefits, followed by the Greater Vancouver Regional District and the City of Montreal. Affectionately referred to as the "Centre of the Universe" by Torontonians in terms of its cultural, political and economic importance in Canada, the phrase is also very appropriate in terms of describing the region's national share of air pollutants (including GHG). Other factors to consider include its proximity to significant amounts of transboundary air pollution, the size of its population (e.g. children and the elderly), and the uniqueness of its ecosystems, forests and agriculture, many which are vulnerable and sensitive to UV-B, acid deposition and ground-level ozone. Just recently, for instance, Toronto Public Health released a study which estimated upwards of 1,000 premature deaths annually caused by air pollution.[22]

CONCLUSIONS

The issue of co-benefits for environment and health from reductions in GHG plus related emissions should be an integral part of a national climate change communication strategy. Not only could the explication of co-benefits play a significant role in this strategy, it may be the single most important message that should be communicated. Environment and health benefits from reductions in GHG plus related emissions accrue locally and sooner, relative to the longer term and global scale benefits that may be achieved by retarding the onset of climate change. Thus, the key message is no longer whether the current state of science provides a powerful rationale to take prompt, prudent action to mitigate climate change, but rather what steps will generate the "greatest return on investment". At the local scale, such as the Toronto-Niagara Region, if this message is insufficient to generate an effective emission reduction response, then it is highly unlikely that Canada will meet its Kyoto target by 2010. ❑

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Session C1

STAKEHOLDER FRAMING OF CLIMATE CHANGE

Negotiating Congruencies Among Multiple Interpretive Frameworks: Elite Representations of Global Climate Change

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Impact of Framing on Willingness to Sacrifice to Reduce Greenhouse Gas Emissions

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Negotiating Congruencies Among Multiple Interpretive Frameworks: Elite Representations of Global Climate Change

Raymond M. Garrison and Bryn Greer-Wootten

In developing Canadian policy, critical issues involve substantive uncertainty and procedural complexities. To foster understanding, constructive criticism and dialogue among stakeholders/elites, an exploration of value-laden interpretations of information is essential. Multiple frameworks may be used to develop a holistic and integrated interpretation of elite representations of global climate change. We focus on a continuum of 'old' and 'new' elites, distinctions fundamentally based on differences in communication flows. Possible congruencies between three frameworks are suggested: Torgerson's 'technocratic - participatory' continuum of policy process orientations; Rayner's conceptual space for strategic decision making ; and our inter-scalar 'people-based' approach to global policy .

INTRODUCTION: THE ISSUES

Conflicting interpretations of the complex and dynamic nature of global climate change issues (Dotto, 1999) continue to hinder the development of a comprehensive and integrated Canadian policy. Uncertainties persist in terms of the nature and extent of potential biophysical, economic and social impacts, particularly at regional and local scales (Chiotti, 1998). Forums to develop response options are increasingly participatory, involving many stakeholder groups. The latter have become more diverse internally, with struggles for dominance as each group advocates competing agendas and strategies, reflecting differences in underlying ideological positions and value orientations. The challenge is not to avoid this complexity, but rather to embrace it. A critical starting point for managing substantive uncertainty and procedural complexities is an exploration of the value laden interpretations of information, used by various stakeholders to bolster their arguments with respect to policy formulation and implementation. This approach can reveal commonalities and clarify differences in policy positions, thereby increasing the mutual understandings of participants and facilitating constructive criticism and dialogue among them.

In this paper, multiple frameworks are explored in order to develop a holistic interpretation of elite representations of global climate change. The aim is to develop potential congruencies among the frameworks in a theoretical manner, in order to explore the possibility of developing a "metaframe" with respect to global climate change. Of central importance is an elaboration of a continuum of old and new elites, essentially reflecting differences in communication flows. This representation is aligned with Torgerson's (1986) "technocratic-participatory" continuum of policy process orientations. As well, relationships to a conceptual space for strategic decision making are considered, a space anchored by Rayner's (1991) ideal-typical nature myths and associated response strategies. Finally, congruencies with an alternative inter-scalar model of global policy formulation and implementation (rather than a traditional "jurisdiction-based" approach) are discussed. This paper summarizes a number of contributions made at conferences recently (Garrison and Greer-Wootten, 1995, 1997, 1998, 1999, 2000).

ELITES AND THE POLICY PROCESS

The traditional view of public policy-making processes involves an essentially linear progression of discrete stages, in a single continuous feedback loop. Interactive feedbacks between the stages are rarely acknowledged, however, and the intensity of the linkages is assumed to be uniform throughout the model. A "function-based" model, suggested by Portney (1992), proceeds through the following stages: 1) Problem Formulation (Public

Agenda Setting); 2) Policy Formulation or Reformulation; 3) Policy Legitimation and Adoption; 4) Policy Implementation; and 5) Policy Evaluation (which feeds back into the first stage).

By focusing strictly on functions, this model fails to identify the role of various actors at each stage. Such an 'actor-based' model could then be developed, providing some relevant loci of control over 'information'. This requires additional stages in the policy-making process: 1) Problem Definition (Elites and Politicians); 2) Problem Analysis (Elites); 3) Option Definition (Elites); 4) Option Delineation (Elites); 5) Option Selection (Politicians); 6) Policy Creation (Politicians and Bureaucrats); 7) Policy Implementation (Bureaucrats); and 8) Policy Evaluation (Bureaucrats). Being in the purview of bureaucrats, the latter two stages now fall outside the policy-making process per se, becoming part of operationalization at programme and project stages. This model reveals the crucial role of elites in the early stages of the process. We argue that as the complexity and level of controversy related to a policy issue grow, the volume and diversity of information that must be distilled into viable response options increases. Due to resource constraints (particularly time and money), politicians must increasingly rely on elites to undertake this task, thereby elevating the importance of elites in the process. This reformulation engenders questions: Who are the elites? What actor groups do they come from? How do they interact within each stage, and between stages?

Re-defining Policy - Re-defining Science

A definition of elites, especially relevant for their role in climate change policy processes, is closely tied to conceptions of 'science'. Arguably, scientific information is a crucial input to environmental decision making. Doern (1993) presents a framework of "players" in Canadian international environmental decision making. The core of his representation centres around the political jurisdictional battles for control between the Department of the Environment and the Department of External Affairs and International Trade. Doern identifies six key domestic stakeholders: ENGOs (Environmental Non-Governmental Organizations), Aboriginal groups, Business, "Other" Federal government departments, Provinces and "Scientists". This typology reflects a traditional conception of scientists as a separate, autonomous and unified actor group. Such is not the case. Minimally, the scientific community can be divided into natural and social science components. More recently, multidisciplinary (natural science) and interdisciplinary (social science) research areas have become relevant collectivities (Garrison, 1996). We would argue that scientific communities pervade all stakeholder groups with respect to environmental issues.

Since the mid-1980s, policy-making processes have become more inclusive, involving an increasing diversity of groups, who bring with them a wider range of substantive concerns. Aside from the private sector groups identified by Doern, the media has emerged as a significant actor group, selectively disseminating information to the general public. Also, academics may be considered quasi-public sector actors, becoming more politically active in decision making, rather than being mere information generators. Science can provide a unified basis for argumentation on environmental issues among these groups, and therefore could be represented as an underpinning foundation for all actor groups. A member of a scientific community may simultaneously be a member of one or more other stakeholder groups. Each person's representation of an environmental issue emerges from a complex synthesis of personal values, traditional scientific community values, and extra-community societal values (e.g., equity and social justice). A scientist may be found within any stakeholder group, depending on how one defines science (Garrison, 1996).

The stakeholder groups that are embracing new definitions of science are primarily the ENGOs, the media, and Aboriginal groups (of course, not all members are doing so). It must be recognized that there is a great diversity of philosophies and substantive concerns among organizations within each of these groups (e.g., ENGOs include Pollution Probe, Friends of the Earth, Greenpeace, etc.). Within each group, however, there are leading individuals whose voice dominates, primarily due to their understanding of both substantive issues and policy processes: these are the elites. Those who advocate the broader definition of relevant scientific knowledge, essentially giving greater credence to qualitative social science, may be termed the "new" elite.

Re-Defining Elites

Sniderman et al. (1991: 352) capture the essence of our basic definition of "elites" as follows:
"It is worth emphasizing that in invoking the concept of elites, we do not have in mind a sharply demarcated ruling class or power elite; on the contrary, we mean only to refer to those who are particularly active in public affairs and hence uncommonly informed about political issues and influential in decisions about them."

"Elites" are key individuals who function in public policy processes as influential **expert option delineators.** They are distinct from, but interact with politicians, who are the elected final decision makers. Traditionally, elites have been engaged in "pre-policy" information structuring processes, which are essentially information gathering, organizing, distilling and synthesizing processes that largely occur outside public policy making per se. Information is 'filtered' into a subset of viable response options, which are then presented to politicians. Since the late 1980s, however, obligatory monitoring and review processes have been incorporated into policies (Doern, 1993), which have led to a more symbiotic process of information exchange between this "exterior" information environment and policy forums. In fact, one may argue that they have merged somewhat.

'Old' and 'New' Elites

There has been a decline in the relative influence of the traditional technocratic 'old' elite, supported by corporate interests, and a concurrent rise of a 'new' elite, primarily from NGOs and the media, who challenge their dominance. These so-called 'new' elites have been present on the political scene for many years, but the recognition of their voices by policy makers is relatively recent. As noted earlier, this is partly associated with the growing legitimacy of 'non-scientific' qualitative information (i.e., non-positivistic social science) as an input to policy processes. This, in turn, reflects an acceptance (at least implicitly) of a broader definition of science. The emergence of the new elite coincided with the second wave of environmentalism, which was clearly evident in the volume of media reporting of environmental events in the early 1990s (Garrison and Greer-Wootten, 2000). Failures of established policy processes to address the unique complexities of global climate change may have strengthened the call for alternative voices.

The major ontological difference between old and new elites is that the former are concerned with 'quantity-of-life', while new elites are concerned with 'quality-of-life'. The former perspective sees a single economic reality, while the latter recognizes the co-existence of multiple subjective realities that need to be reconciled prior to the development of a response strategy. The epistemology of the old elites is founded on a faith in science and technology, a reductionist approach to the simplification of a problem in order to find its 'correct' solution. The new elites, by contrast, take a critical view of science and technology, which embraces the complexities of problems within their context, in relation to broader issues. They are guided by the realization that science is not, nor can it ever be, all knowing, since 'truth' is relative and contextually determined. As such, they are more likely to favour situationally-specific lifestyle modification responses. The ontologies and epistemologies of elites strongly influence their methodological approaches to issues and problems.

Definitional Congruencies

The different attributes of old and new elites are congruent with an underlying policy value orientation continuum, from 'technocratic {= old elite}' to 'participatory {= new elite}'. This framework emerged from a critical evaluation of Torgerson's (1986) three "faces of policy analysis" (Garrison, Goulet, and Greer-Wootten, 1994). Torgerson presented policy analysis at the intersection of the 'knowledge' and 'politics' spheres. A dynamic internal tension is present because the concepts of knowledge and politics are constantly changing and are dialectically opposed, and as a result "different aspects become salient at different moments" - policy analysis "takes different forms, projects different faces". He implied a 'social learning process' occurring over time, which results in "each new face emerging from past developments", although they also overlap and co-exist. This evolution of policy analysis parallels paradigm shifts in the philosophy of the social sciences.

Torgerson's 'first face' may be strongly related a theoretical extreme of the old elite: technocratic, 'objective' knowledge purports to replace politics in decision-making processes (cf. Steed, 1988). The socio-political value orientation associated with 'first face' policy analysis is a technocratic rationality, in which the power of elites is uncontested, thereby maintaining 'status quo' power relations. Policy is constructed through policy analysis, in order to 'improve' society. In the 'second face', politics "masquerades" as knowledge. Critiques of conventional first face policy analysis expose an "irrational technocracy", and elite power is contested in an adversarial political process - stakeholders selectively generate and utilize technocratic information to support their own respective pre-set policy goals, under the guise of objectivity. Policy goals are seen as being derived by a political process, not from techniques, in this second face. Knowledge and politics attain a measure of 'reconciliation' in Torgerson's 'third face', reflected in the collapse of his constructed epistemological "knowledge - politics" continuum. A third face analyst conducts the "art" of policy analysis, acting as a context-aware, self-reflective, non-expert whose role is to obtain interpretive knowledge (Fischer and Forester, 1993) of an issue in context, through a collective and cooperative social process. This necessitates the understanding of her/his own role within the knowledge-production process (Murphy, 1986). Policy analysis is no longer viewed as an explanatory science, but as a mode of understanding society.

ELITE COMMUNICATION FLOWS

The consideration of epistemological and methodological differences between old and new elites highlights significant congruencies between the 'old-new elite' continuum and Torgerson's (1986) 'technocratic-participatory' continuum of policy value orientations. More fundamental factors, in a political sense, for differentiating old and new elites, are communication flows. This is reflected in the nature of their communication dynamics in policy processes, as well as the content and form of communication. Their scale of concern and the distribution of their networks over space are also primary aspects these communication flows (Mormont and Dasnoy, 1995).

Old elites exert a direct influence over policy development, associated with a specific stage in the process. Their linear communication is in the form of a focused and targetted bilateral transmission, to a single private audience (i.e., decision makers). Not surprisingly, the content of such communication is technical, and takes place within a restrictive agenda-setting process, where there is issue congruence among linked elites (i.e., they share similar definitions). Most communication is in written form and in formal language, delivered with a singular level of discourse.

New elites, by contrast, have direct as well as indirect (via other stakeholder groups) influence over policy development and implementation. They remain engaged in continuous conversation throughout most, if not all, the overlapping policy stages. Their open and diffuse communication is characterized by a non-linear multilateral flow to multiple audiences, both public and private. The content is more accessible, as technical aspects are often situated within the context of quality-of-life concerns. It occurs within broader and inclusive agenda-setting processes, which can be quite dynamic, encouraging diverse opinions, often using multi-media modes. This has broader implications for scientific communication in public policy processes - science must be communicated in both technical and lay terms.

The old elite network is more bounded geographically, tending to function on one scale of concern - local, national, or global. The new elites participate in a diffuse and widely-distributed network, which can be global in scope. They have embraced the Internet. The communicative processes are more complex, as stakeholders negotiate their position among competing interests. They share multi-scalar concerns, seeking to reconcile traditional jurisdictional scales with the ecological processes that transcend them.

OLD AND NEW ELITES IN A CRITICAL POLICY PROCESS FRAMEWORK

This theoretical framing of communicative linkages engenders a 'critical' model of public policy-making processes in Canada, which seeks to address some of the limitations of the 'liberal' actor-based model discussed earlier, and provides a more detailed representation of the non-linear and communicative aspects of actual policy processes today. With this model, we shed some light on the question posed earlier regarding how elites interact within each stage and between stages.

Over time, the policy-making process does follow a general temporal linearity, associated with a narrowing of broader issues into problems, then ultimately into operational programs and projects. Diagrammatically, this would give the process a triangular form - one that is broad initially and filters down to the bottom. Such a representation should no longer be thought of as a series of discrete stages, but rather as a continuous process: stages may be thought of as overlapping 'segments'.

There are complex communication flows, with continuous feed-back loops, within and between segments. Rather than representing linkages with two-way arrows 'between' stages, then, entire adjacent regions merge, delimiting a 'zone' of non-linear communication flows. This changes the representation into a three-dimensional 'cone'. Within the cone, in the aggregate, there is a general flow of policy information filtering down, with compensating counter-flows of 'policy evaluation' feedbacks. The boundary of the policy cone represents the institutionalized structures for policy making, and varies in permeability. Outside, it is bounded by 'society'. The wide top of the cone has the most permeable boundary, allowing the 'real world' freely to enter the 'Problem Definition' segment of the policy process, only minimally impeded by political structures. It is in the 'Problem Definition' segment that new elites, old elites, and politicians interact. It is here that new elites exert their strongest influence, as they enter the zone between policy making and society, bring in societal agendas. Politicians play important but relatively minor roles here, but the links between them and the old elites aim to preserve the 'status quo'.

The intersection with the 'Problem Analysis' segment contains the most intense zone of interaction between old and new elites. The voices of the latter are relatively equal to those of the old elites, who for the most part remain entrenched, but whose views may be modified by the interactions. As both try to assert their agendas and advocate different approaches, there is a dynamic confrontation between their value systems. Every individual is compelled to introspectively negotiate conflicts within themselves regarding their personal, institutional and societal value orientations toward issues and problems raised (Sabatier, 1987). This internal battle is reflected in changes in policy positions: from every conflict, a modified, and hopefully more clearly-defined standpoint may emerge.

As the policy process narrows into the 'Option Definition' segment, the intensity of flows between old and new elites decreases. The old elites maintain their long-established voice in the policy process, but the new elites' alternative voices are heard less and less, gradually being overwhelmed by forces to maintain the status quo. They become absorbed into the established process, often as members of government commissions or roundtables that are participatory in form, but often have pre-defined procedural parameters which favour a technocratic 'practicality'.

By the 'Option Selection' segment, the communication between old and new elites has markedly diminished. The new elites are at their weakest, as 'radical' options are eliminated in favour of more politically-feasible solutions, which minimally disrupt the lifestyles of 'voters'. By contrast, the voice of the old elites maintains its strength, unchanged from the previous two segments. The subsequent segments reside in the purview of the politicians, but the general feedback flow of continuous policy evaluation is still important. The bottom of the cone closes abruptly with the strongly-bounded 'Policy Implementation' segment, which is administered by the bureaucracy, and therefore is outside the policy-making process per se. There is a fairly strong boundary between this segment and the preceding one, as the limits of implementation are prescribed by policy.

CRITICAL POLICY PROCESSES AND INTERPRETIVE FRAMEWORKS

Another potentially useful framework for more substantive understanding of the content of elite communication flows is based on the work of Rayner (1991). Through an examination of language use in context, sub-groups of elites may be identified based on their "decision styles", implicitly or explicitly conveyed through their arguments (Briggs, 1986). Such styles may reflect the value-laden acceptance of certain ideal-typical "nature myths", and associated response strategies. These have been delimited by Rayner as: 1) Preventivist ("Nature is Fragile"); 2) Adaptivist ("Nature is Robust"); and 3) Sustainable Developmentalist ("Nature is Robust within Limits").

These myths constitute three anchor points in a conceptual space for strategic decision making. An understanding of the extent of overlap between these "sub-spaces" is an essential precursor for global climate change policy formulation, since it is at such intersections of myths that a unified strategic value orientation for Canadian policy could be defined. Rayner (1991: 75) contends that "decision styles systematically constrain discourse and lead decision makers to frame problems in specific, sometimes incompatible ways".

Rayner has also made a valuable contribution to the climate change policy debate in his analysis of the processes involved in negotiations leading to the Montreal Protocol (cf. Ungar, 1998). Essentially, he compares a traditional 'Realist Model' [based on jurisdictions with vertical communication linkages] to a 'Polycentric Regime Model' [based on horizontal linkages between relevant actors], which more adequately accounts for the successful negotiations. We have two main critiques of this model. Firstly, it does not depict intra-national local or regional scales, nor the diversity within each of the institutional types. The internationalization of "NGO's" and "Environmentalists" is questionable, given their localized ideological diversity on some aspects of issues. Horizontal ties are not only discrete and parallel as suggested in the model; there can also be some cross-linkages among them, representing multi-institutional policy efforts occurring outside traditional policy realms (e.g., ENGO-business coalitions: see Doern and Conway, 1994).

Our second critique focuses on the need for consensus. We question the need for full national consensus on global environmental issues, in light of these influential horizontal linkages. Do we need consensus among institutions of the same general type (e.g., ENGOs), or should diversity be preserved and encouraged? We argue that as issue uncertainty and complexity increase and issues become less 'technical', the tension between vertical and horizontal linkages increases. This model, therefore, has limited value for conceptualizing global climate change policy processes, for which the assumed uniformity of intra-national consensus breaks down due to local scale variations in potential impacts.

In order to reconcile the horizontal and vertical flows, we have developed an "Inter-Scalar Model". It illustrates a cross-section of dynamic communicative linkages among elites at different scales at one point in time. In addition to the global scale, it introduces localities as an important consideration in policy formulation and retains the national scale in an intermediary position. Globally, linkages are strongest among the 'Corporate / Business' elites, such as leaders of transnational corporations and international funding agencies (e.g., the World Bank). They are also strong among scientists (e.g., members of the IPCC and the World Meteorological Organization). At the local scale, communication channels are strongest among a diversity of ENGOs, who position themselves as a 'voice' for local concerns. Unlike Rayner's approach, this model identifies inter-scalar communicative linkages, potentially improving the understanding of local-global relationships. There is the possibility of flexibility in the implementation of global climate change imperatives, since the model focusses on the role of local elites. This may enhance the potential for the adoption of lifestyle modifications by the public. The grassroots nature of the model suggests that implementation may in fact precede policy! It is also in line with a more participatory approach to policy making. Given the assumption that local diversity is valued, we assert that a full national consensus for global climate change is not required.

CONCLUDING REMARKS

The framework of critical policy analysis reflects an increasingly participatory orientation of public policy-making processes by recognizing the role of new elites as a challenge to the hegemony of old elites. The orientation is strongest in the early segments, then there is a shift toward the technocratic pole of Torgerson's continuum as the process progresses through later segments. Pre-established procedures and conceptions of 'practicality' asserted by the old elites predominate, reflecting the technocratic inertia of government institutions. With respect to environmental issues, the intense interactions in the first two segments of the policy-making process reflect, in part, a clash of Rayner's diametrically-opposed preventivist and adaptivist perspectives, associated with new and old elite constructs, respectively. Earlier debates on global climate change response strategies in the professional periodical literature illustrate this polarization, with authors advocating one or the other approach. Still, this model holds out hope for a sustainable developmentalist response strategy for policy making because of its bottom-up approach to knowledge generation and openness to alternative voices. It also identifies institutional rigidity and inertia as significant barriers to sustainable development in the later segments of the model, which may lead to a preference for a more technocratic adaptivist response strategy.

The imperative of developing inter-scalar responses to global climate change is somewhat addressed by this framework. Again, in the early segments of the policy process, the new elites are permitted to bring forth agendas and ideas from many jurisdictional scales. Of necessity, as the process evolves, the mandated jurisdictional responsibilities of the politicians become a primary concern for elites, and problems begin to be thought of within the single scale in which solutions will be implemented. What is important, however, is that the specific-scale responses will be developed within a larger inter-scalar context. The local scale is no longer just the receiver of policy, but actively involved in its design, particularly via ENGOs, the media and other new elites. ❑

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Impact of Framing on Willingness to Sacrifice to Reduce Greenhouse Gas Emissions

Robin Shudak, Robert E. O'Connor, Brent Yarnal, Richard J. Bord and Ann Fisher

This paper explores the impact of the spatial frame in which people interpret climate change. In 1999, 637 respondents completed a mail survey in five counties in central Pennsylvania. Half of the sample framed climate change in terms of local impacts from mitigation policies, while the other half framed climate change in terms of national impacts from mitigation policies. The results show a statistically significant, but effectively unimportant difference between the local and national frames in the respondents' willingness to support government policies as well as take voluntary actions to mitigate climate change.

INTRODUCTION

Framing is the process by which a communication source defines and constructs a political issue or public controversy. One way to frame an issue is to focus on the spatial dimension, giving it either a local or a national frame. Individuals encouraged to put an issue into a local context may reach different conclusions about that issue than people encouraged to see the issue in a national frame.

Public issues have both definitions of a problem and proposed solutions. This research looks at the latter, not the former. In other words, we do not present scenarios of possible impacts of climate change for a local area or the nation. Instead, we deal with the costs of mitigation strategies for a local area or the nation.

The goal of this research is to determine whether the framing of climate change mitigation activities in a local or national context influences respondents' willingness both to take voluntary steps to reduce greenhouse gas emissions and to support government policies designed to reduce greenhouse gas emissions. To achieve this goal, we administered two versions of a survey to residents of central Pennsylvania. One version focused attention on the local area and the costs of mitigation proposals to local industry, coal miners, and drivers. The other version presented the costs of mitigation proposals in national terms.

FRAMING

Although the first papers concerning the ideas of framing appeared in 1922, Erving Goffman only coined the term in 1974 (Iorio 1996). In the last 20 years, there have been studies of the effects of framing on issues such as AIDS, political attitudes, gambling, abortion, and affirmative action. Zaller (1993) concludes that framing is central in opinion formation.

Entman (1993) posits that framing has four functions: to define the problem; to diagnose causes; to make moral judgements on the causal agents and their effects; and to suggest remedies while predicting their likely effects. He argues that framing is especially useful when the public is neither well-informed nor actively seeking solutions to a problem. Such is the case with climate change (Bord et al. 1998).

METHODOLOGY

Study Area

The study site consists of five counties in central Pennsylvania: Centre, Clearfield, Clinton, Snyder, and Union

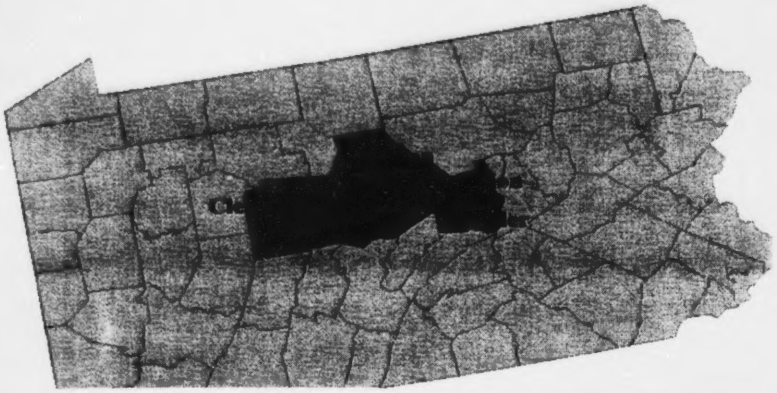
(Figure 1). The region contains no significant urban areas, except for the growth pole in Centre County surrounding the Pennsylvania State University. The population is mainly Caucasian (96 percent) and income is lower than the national average. Although historically the economy revolved around the coal industry and agriculture, most of today's revenues result from the service sector and light manufacturing. The Pennsylvania State University is the number one employer.

The five-county region has per capita greenhouse gas emissions higher than the national average (Easterling et al. 1998). About 67 percent of households use sources other than natural gas or electricity to heat their homes, compared to the national average of 23.2 percent. Those other sources are most often coal because it is inexpensive, abundant, and the geology of the region makes the installation of underground gas lines difficult. The area also contains two large coal-fired power plants, and coal use by central Pennsylvania's business and industry is far greater than the national average. Because of central Pennsylvania's dependence on coal for energy, most mitigation proposals entail a substantial cost to the area (Denny et al. 2000).

The Survey

Following a modified Dillman (1978) approach, we implemented a mail survey of residents of central Pennsylvania in winter 1998-99. Using a purchased sample created from multiple sources, including property tax rolls and telephone books, we mailed 1,200 packets to residents of the five counties. Each packet contained a survey booklet, cover letter, addressed and stamped return envelope, and a dollar bill as an incentive to complete and return the survey. In Week 2, reminder postcards were sent to all 1200 residents. In the fourth week, a second packet without the dollar was mailed to the respondents who had not replied to the first mailing. Of the original sample of 1200 potential subjects, 169 surveys were undeliverable, thereby reducing the sample to 1031. Of these, 637 responded for a response rate of 62 percent.

FIGURE 1: Five County Study Area in Central Pennsylvania, United States.



The survey instrument was a booklet with 11 pages of questions divided into 5 sections. The first section (2 pages) asked about personal goals and economic anxieties. The next section (1 page) asked about global warming: its causes and likely consequences. The third section (2 pages) concentrated on electricity and vehicle use. The fourth section (2 pages) investigated willingness to sacrifice in order to mitigate possible negative impacts of climate change. The final section (2 pages) asked about values and demographic characteristics.

The sample was split based on the experimental variable, framing. Half of the potential respondents received a version of the survey booklet with national framing, while the other half received a version with local framing. National booklets had United States maps on the covers with the title "Issues Affecting You and Your Country,"

TABLE 1. Wording of Framing Questions

National	Local
Q2 Now we'd like your opinion about how you see the economy for people in America. For each of the following, please circle the number that best reflects your beliefs and values.	Q2 Now we'd like your opinion about how you see the economy for people here in Central Pennsylvania. For each of the following, please circle the number that best reflects your beliefs and values.
Today's youth will have a better living standard than their parents	The youth of Central Pennsylvania will have a better living standard than their parents
In today's economy, working harder does not always mean getting ahead for the average family	In today's Central Pennsylvania economy, working harder does not always mean getting ahead for the average family
Today's economy has made it easier for families like yours to make ends meet	Today's economy has made it easier for families like yours in this region to make ends meet
The average family has to work harder to stay in the middle class than previous generations	The average family in this region has to work harder to stay in the middle class than previous generations
In terms of good jobs, America's best years are yet t come	In terms of good jobs, Central Pennsylvania's best years are yet to come
Layoffs and loss of jobs in this country are just temporary problems	Layoffs and loss of jobs in this region are just temporary problems
Most Americans can feel secure about their jobs	Most residents of this region can feel secure abut their jobs
Families like mine will not do as well financially as they expected	Families like mine in Central Pennsylvania will not do as well financially as they expected
Q 18 (information provided about global warming, then questions asking vote choices on four hypothetical national referenda)	
An **energy tax** to fund a new government program to replace power plants that burn coal. The program would replace coal plants across the nation with new plants that would use cleaner sources of energy. This program would cost each household about $20 per month.	An **energy tax** to fund a new government program to replace power plants that burn coal. The program would replace our two coal plants (in Clearfield and Union Counties) with new plants that would use cleaner sources of energy. But these new plants might not be located in our region. This program would cost each household about $20 per month.
Tough new regulations would discourage the use of coal. About half of the nation's coal mining jobs would be lost if the new regulations were adopted. These regulations would raise the price of electricity, adding $20 per month to the typical electric bill.	**Tough new regulations** would discourage the use of coal. Approximately 900 coal miners work in our five county region, and many more people derive their income from supporting coal mining operations. About half of these jobs would be lost if the new regulations were adopted. These regulations would raise the price of electricity, adding $20 per month to the typical electric bill.
A 10 percent **"gas guzzler" tax** on vehicles that get less than 25 miles to the gallon (an added $2000 to the price of a $20,000 vehicle). Many Americans own low-mileage vehicles such as pickup trucks, sort utility vehicles, and minivans.	A 10 percent **"gas guzzler" tax** on vehicles that get less than 25 miles to the gallon (an added $2000 to the price of a $20,000 vehicle). Our mountainous rural region has a high proportion of low-mileage vehicles such as pickup trucks, sort utility vehicles, and minivans.
A national **tax on businesses that use coal and oil in their manufacturing.** This encourages fuel substitution (natural gas or solar or wind replacing coal) by manufacturing plants that now use coal. Some firms may choose to move out of the country. This tax would raise the cost of most things you buy by 2 percent (about $20 per household per month).	A national **tax on businesses that use coal and oil in their manufacturing.** This encourages fuel substitution (natural gas or solar or wind replacing coal) by manufacturing plants that now use coal. Some local firms (e.g., lime production) cannot move; others may choose to move out of the area or out of the country. This tax would raise the cost of most things you buy by 2 percent (about $20 per household per month).

while local booklets had a map of the five-county study area and the title "Issues Affecting You and Your Community." Accompanying cover letters also explained the goals of the study in terms of corresponding national or local context. Respondents were given no indication of the existence of a split sample. Table 1 presents the exact wording of the two multiple-item questions with local or national frames.

RESULTS

In both the national and the local frames, most respondents do not support climate change-friendly legislation and are unwilling to engage in expensive or difficult personal measures. Exceptions do exist, but these exceptions tend to be in inexpensive, easy to implement personal options that make immediate financial sense, such as buying a energy saving lights and switches and lowering the thermostat on the hot water heater. On the other hand, there is no consensus against efforts to reduce greenhouse gas emissions. Half the respondents indicated they would vote for a gas-guzzler tax and a substantial minority, between one-third and one-half of the sample, supported each referendum and checked that they would take each voluntary action. Only "using mass transit more frequently" is rejected by almost everyone, a not surprising result in a region that provides no mass transit service for many residents. Among respondents who opposed the referenda, more circled the "probably no" than the "definitely no" option. Similarly, among respondents who would not take voluntary actions, most did not circle the extreme "very unlikely" response. Opposition to greenhouse gas mitigation policies and unwillingness to take voluntary steps to reduce greenhouse gas emissions is neither intense nor universal.

The spatial frame does seem to influence support for some government policies. Table 2 shows that more individuals exposed to the national frame supported an energy tax and tough new regulations that would eliminate many coal-mining jobs than did respondents exposed to the local frame. For a gas guzzler tax and a national tax on businesses that use coal or oil, differences are also in the direction of more support by people exposed to the national frame, although the difference do not attain statistical significance. In essence, telling people that an energy tax will shut down two local coal plants and tough new regulations will cost local jobs does reduce support for the hypothetical energy tax and regulations. What may be more surprising is not that there is drop in support in comparison with the national frame, but that the drop was only 8 percent. Thirty-six percent of people exposed to the local frame still said they would vote for the energy tax and 28 percent would vote for the new regulations.

The next question in the brochure asked people if they would be willing to take a number of voluntary actions if the United States makes a commitment to reduce its own greenhouse gases by 20 percent. Logically, there is no reason to predict that either frame would be more likely to encourage people to indicate their intentions to take voluntary actions. Table 3 shows that, for five of the actions, there is a statistically significant difference between the national and local frames. In each case, respondents exposed to the local frame were less likely to say they intend to engage in the action. Perhaps, for some local frame respondents, the referenda items with their talk of local layoffs and plant closings produced a sour mood toward doing anything to reduce greenhouse gas emissions. It would be interesting to see if the finding of less willingness to act voluntarily by respondents exposed to the local frame would hold if the order of the two multi-item questions were reserved. In other words, respondents

TABLE 2. Support for Government Policies by Frame

	% Definitely or Probably would Vote For		Significance?
Referendum[a]	National Frame	Local Frame	
Energy tax	44	36	.05
Tough regulations	36	28	.05
Gas guzzler tax	53	47	NS
Tax on manufacturing	47	44	NS

[a] See Table 1 for exact wording of each referendum. N's vary from 602 to 612 with missing data

TABLE 3. Willingness to Take Voluntary Actions by Frame

	% on "very likely" side of 5-point scale		Significance?
Voluntary Action[a]	National frame	Local frame	
Buy a new furnace that would burn natural gas instead of electric heat	34	32	NS
Purchase new, more efficient appliances, (such as dryers, stove, refrigerators)	44	38	NS
Purchase a more efficient water heater	51	46	NS
Lower the thermostat on your hot water heater	59	58	NS
Lower the thermostat in your home during the winter (keep home about 5 degrees cooler)	50	49	NS
Raise the thermostat on your air conditioning unit(s) during summer (keep home about 5 degrees warmer)	57	51	.05
Purchase energy-saving lights and switches	64	59	NS
Purchase new or thicker home insulation	44	37	.05
Purchase solar panels or other solar energy decides	27	21	.05
Purchase a vehicle that gets at least 5 more miles per gallon than your current vehicle gets	46	37	.05
Car pool at least a couple of days each week	22	20	NS
Drive at least 20% fewer miles per week	29	18	.001
Have your vehicle inspected at least twice a year for gasoline efficiency, emissions problems, and fuel leaks	41	36	NS
Drive 55 miles or less, even when the speed limit is 65 mph (because miles per gallon is higher at 55 mph)	31	32	NS
Use mass transit at least twice a week	15	12	NS

[a] If the United States decided to join an international effort to slow global warming and committed to reduce its own greenhouse gases by 20 percent, how willing would you be to take each action listed below:

N's vary from 579 to 610 with missing data

would first indicate their willingness to take voluntarily actions and then read the descriptions of the local or national costs associated with the four government policies designed to reduce greenhouse gas emissions.

CONCLUSIONS

Framing matters, but not a lot. Only in the case of expressed willingness to drive at least 20 percent fewer miles per week is the difference between the national frame and local frame respondents at least 10 percent (29 percent of the national frame respondents and 18 percent of the local frame respondents). Still, there are statistically significant differences for seven individual items. When we factor analyze item responses and create scales, the resulting scale scores for the referendum support and voluntary actions scales are substantially different for the national frame sample and the local frame sample.

The implication of the impact of framing is not that communicators of climate change information should only discuss climate change by providing a national or global frame. First, our brochure only discussed the costs of programs to reduce greenhouse gas emissions. The local frame provided information about potential lost local jobs from mitigation policies, but did not provide information about the potential local consequences from climate variability and change. Thus, the information on the climate change issue was incomplete. Second, the impact of the local frame may be contextual, depending upon the local situation. Unlike coastal areas in the Mid-Atlantic Region, Central Pennsylvania has little vulnerability to potential climate variability and change resulting from the buildup of greenhouse gases in the atmosphere (Fisher et al., 2000). In light of the importance of coal to the local economy, it would be reasonable for a knowledgeable resident of Central Pennsylvania to conclude that the region faces a greater threat from government policies designed to reduce coal use than from climate change. If we were to replicate this study in the Florida Keys, the impact of the spatial frame might well be different. ❑

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Session C2

COMMUNICATION AND THE SCIENCE-POLICY INTERFACE

The Science-Policy Process:
Communication Distortions at Each Iteration
Jon Rosales
University of Delaware

Communicating with the Media:
A Scientist's Perspective
David Viner
University of East Anglia

The Communication and Utilization of Research-Based Information: Moving Within and Beyond (Climate) Impact Assessments
Roger Pulwarty[1] and Stewart Cohen[2]
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On the Role of Research Programmes in Climate Change Communication. Experiences from the Dutch National Research Programme on Global Air Pollution and Climate Change
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The Science-Policy Process:
Communication Distortions at Each Iteration

Jon Rosales

A central concern of the climate change science-policy process, with uncertain science and faulty impacts work is: how can we have good policy? The temptation is to circumvent iterations to reduce the magnification of uncertainty. This temptation has basis in the Western legitimizing agents of reason and efficiency, but a third agent - democracy - necessitates the inclusion of messy politics. A better approach is to seek to diminish the uncertainty between the iterations by recognizing the nature of the science, impacts and policy realms for better understanding of these iterations and to lessen the science-policy communication distortions.

INTRODUCTION

> *It has been claimed that the uncertainty present in individual climate models' predictions of the climate of a greenhouse-warmed world 'explodes' as reference is made to other climate models; as impact models are used to predict impacts especially when more than one impact model is used and finally as these predicted impacts are fed into the policy formulation process... As long as uncertainty exists at each stage in the assessment process, the overall range of projections will grow.*
> (Henderson-Seller, 1993: 206)

Climate change has emerged from the realm of science as a social event that ebbs between economic and political forces. Uncertain scientific evidence only goes so far in this charged environment as it is distorted, ignored or refuted by economic and political interest. The uncertainty that mires the science, impacts and policy iterations of the climate change policy process, stem from the nature of the institutions involved - science, economics and politics. The institutions involved, in turn, incorporate the standards of contemporary Western legitimacy - scientific reason, economic efficiency and democratic governance. These legitimizing agents justify theory in the name of science, justify action in the name of efficiency, and justify power in the name of democracy. These three standards, while ubiquitous, are often incompatible, especially in the case of climate change. For effective climate change policy, however, they must be upheld.

This essay examines the three iterations of the climate change policy process and the uncertainty that is communicated between these levels. It is argued that the nature of the uncertainty of each iteration is inherent in the nature of the institutions that dominate the iteration. This messy accumulation of cascading uncertainty makes it appealing to bypass certain levels of the process for more expedient, timely and certain policy implementation. Such a short-circuited policy process is justified by favoring the legitimizing agents of reason and efficiency over democratic governance. This, it is suggested, has serious repercussions for citizenship and individual freedom and for the credibility of science.

THE CLIMATE CHANGE LEGITIMIZING AGENTS

In the Middle Ages, the Church was Western society's legitimizing agent. The Church guided life questions, deep and ordinary, on a day-to-day basis. Scriptures, tradition and momentum guided proclamations of truth. It was an era of full authority, but it did not last. The Renaissance started a process that gutted the authority of the Church by resurrecting dignity and respect for human ability. The infusion of information from Greek and Roman sources renewed confidence in the human ability for knowledge acquisition. This process took root in the Enlightenment period as faith in the ability for reason made truth and knowledge accessible. By the power of reason, humanity had the ability to control the world, to know all its secrets, to master its ways and to turn them to satisfy desires. Science fell in with this formal structure of knowing and emerged from this period as Western society's new legitimizing agent.

Reason was also applied in the social sciences to produce another standard of legitimacy - economic efficiency. It is now thought that applying reason to social endeavors will uncover least-cost organizational structures. The intent is to draw social processes (including production processes) in line with this least-cost criterion. For over 200 years, the discipline of economics has refined social theory for this purpose applying this standard to underline and direct social activity at all levels. To produce more with fewer inputs and lower costs is the mantra for business, profit, non-profit, government and households sectors alike.

A third legitimizing agent emerged out of the Enlightenment - democratic governance. As the dignity for humanity expanded so was the normative preference for social governance that acknowledges individual self worth. Democracy was envisioned as the system of rule of all people by all the people (although the 'all the people' is usually a simple majority and excludes some members of society). The institutions developed to actualize this legitimizing agent include majority rule, republicanism and representative government.

These legitimizing agents underline the climate change science-policy process. President Clinton's Climate Change Proposal for the Kyoto Conference in 1997, for example, is quite clear about the role of science and economic efficiency. The process is - to be guided by science; to use market based common-sense tools; to seek win-win solutions; to have global participation; and to be subject common-sense reviews (Clinton, 1997). The guiding standards of legitimacy - science and economic efficiency - are clearly stated in these principles. Science is to be the foundation for action and economic efficiency is the standard used to rank the differing responses.

The United Nation's climate change policy process is also founded on the same legitimizing agents. The Intergovernmental Panel on Climate Change (IPCC) follows the standards of legitimacy as the basis of their operational method. It uses a three working group process that bases its assessments in sequence. Working Group I assesses the state of climate science. Working Group II bases their social impacts assessments on the scientific assessment of Working Group I. Working Group III considers the mitigation of climate change based on the assessments of Working Group I and II. The actions of the IPCC policy process start with science as the foundation for action and use economic efficiency criteria to assess mitigation options. The assessments are used to formulate protocols that are binding if ratified by member states. This final and most contentious step applies the legitimacy of democratic governance.

President Clinton's and the IPCC's climate change science-policy organizational structures are based on the legitimacy of reason (science), economic efficiency (impacts) and democratic governance (policy). But these are often incompatible. The climate change policy process combines these "highly indeterminate systems in a frantically ambivalent embrace" (O'Riordan, 1995: 34). Their ubiquity is insufficient to ensure full-proof policy. Distortions necessarily arise between these iterations and represent a process of cascading uncertainty. The iterations make due with incomplete information relying on their operating principles to guide decision-making. These operating principles determine the character of the three iterations. Understanding the character of the iterations, then, is crucial for improved communication and understanding of the intent and findings of each level, and ultimately better policy.

THE CHARACTER OF EACH ITERATION

Although one has to be careful not to make caricatures of these levels, it is important to characterize the nature of the iterations for more effective policy. It is important to recognize that each level is characterized by the necessity of the institutions involved adhering to their various legitimizing criteria. Science communicates hypotheses for further testing representing a never-ending process of inquiry using reason. Impacts assessments transform the scientific hypotheses into social currency that are ranked by their economic efficiency. Policy gives the impacts assessments social and political purpose based on democratic ideals. The varying intents dissuade common communication between the levels. Therefore, it is necessary to understand the intent of the iteration to be able to interpret the character of the results given. In this section the character of science, economics and policy is laid out along with examples to illustrate the nature of the iterations involved.

Climate Change Science - Reason

Science is carried forth in an empirical, orderly and reviewed fashion of applied reason - the Scientific Method. The Scientific Method prods scientists to be cautious, to be skeptical and to strive for precision where the lack of information, anomalies or uncertainty is the basis for inquiry. This method follows a sequence of four steps from induction to deduction to prediction to testing (see Holt, 1982: 5). The first step is to gather information on the problem in question and, by using induction, derive a theory. The second step is to deduce predictions from the theory generated in the first step. Investigation of data that can be used to test the theory is then gathered. Fourth, confronting it with evidence tests the theory. Testing either rejects or accepts the theory until a better theory is found. This open-ended fourth step keeps scientists in a state of perpetual re-testing and search for better data, evidence and theory. The ultimate goal is to uncover that which cannot be proved otherwise - 'truth'.

The Scientific Method, as an extension of Enlightenment thought, is an endless application of reason in the pursuit of refining knowledge acquisition. "By discarding the bad ideas and confirming good ones, the scientist has a unique opportunity to clear up conflicting ideas into a systematic body of objectively confirmed knowledge" (Holt, 1982: 6). It is a process of continual searching and questioning where no theory or law is beyond question.

In the climate change science-policy process, General Circulation Models (GCMs) are used as the basis of the IPCC science assessments. Climate models attempt to replicate the forces that makeup the atmosphere to create a plausible simile. The intent is to include enough variables to offer a simulation that responds like the natural system and to create past and future data for verification and forecasting.

Like the other areas of climate change science, GCMs are not immune to uncertainties. It is the nature of science to uncover and dwell on these anomalies, but it is fully expected that the anomalies can be solved if the proper dose of reason is applied - understanding takes time. GCM researchers are equally optimistic. Legates (1999) identified that GCM uncertainty arises because the science of physical flux processes are not well understood, that there is a lack of adequate data, and that there is limited computer technology and modeling capability. Since scientists are currently unable to know all the extensions of climate, assumptions need to be made and variables held constant. This varies GCM model results. The IPCC's Working Group I reports the average from the various models. These averages are passed on to the impacts community as scientific consensus even though the range of output results does not look good independently. Legates (1999) explains that the models greatly distort temperature and precipitation at high latitudes (some models are off by 20(C or more in polar regions, yet polar temperature changes drive many of the concerns for global change) and the models have never been good at modeling atmosphere over ice and desserts. Clouds, ice and ocean surface variability are particularly challenging to model. The crucial features that are missing are at the sub-grid level where important variables, like river variables, are not included. Generally the problem with GCMs is that one incorrect variable amplifies in the large scale. These uncertainties in GCM modeling science cascade onto the impacts community.

Climate Change Impacts - Economic Efficiency

The impacts iteration, which considers the costs of and mitigation of climate change, attempts to transform the incomplete and uncertain scientific results into social science assessment. The necessity of accepting scientific uncertainties is only the beginning of the problematic nature of this iteration. As O'Riordan aptly observes, the impacts iteration:

> shows in poignant contrast the triumphs and tragedies of the use of social science analysis in the policy process. Unlike natural sciences, the social sciences share neither a common outlook nor a common methodology. Social scientists squabble among themselves about the purpose, meaning and relevance of their labors. Consequently, they never agree about what role to play in the policy process and they do not send a uniform message to the policymakers who must formulate a response (O'Riordan, 1995: 34).

Appropriately, the realm of economics reigns at the impacts level, even though its methods are speculative and "less amenable to convincing analysis" (Skolnikoff, 1999: 19). This discipline has fully applied the promise of reason to reveal 'truth' as it assumes away inconsistent and non-quantitative parameters of social activity. The focus is on that which can be measured. This arithmomorphic inquiry tends toward an "isolated, self-contained and ahistorical process" treating events as existing independently of one another (Georgescu-Roegen, 1971: 2). Economics, like no other social discipline, bowed in acquiescence to this method in hope of a mechanistic theory of choice - especially in the measurement of utility.

Like their ecological counterparts, social elements cannot, however, be considered with the same method since the diversity of social processes is often more important than their common properties. Arithmomorphism has its place in the social realm; such as in predicting a coin toss. But to predict the demand for climate change abatement, for example, is a discrete event that must be studied in context. Georgescu-Roegen (1971) referred to this as the ordinalists error - the supposition that wherever there is order there is measure.

Arithmomorphic processes in economics have transformed the discipline into locomotive theory following that is evident in the climate change impacts work. The inquiry process at this iteration is a test to correctly identify a predetermined answer established by the method. The debate within this iteration revolves around how to use the method rather than of its adequacy. This method necessarily reduces social processes to their mechanical analogue to fit the theory. By using a quantitative method to assess that that is not quantitative undermines understanding and distorts communication. It is driven by the perceived necessity to quantify economic efficiency in social processes affected by climate change.

Beyond the inadequacy of economics, impacts work has other challenges that augment the already serious uncertainties of climate change science. Impacts work must distill the climate change science. Impacts researchers look at the GCM averages assuming constant variation while ignoring extremes. However, it is possible that the climate averages remain unchanged with time but the variation changes. This is significant because weather extremes cause the most damage.

There are other uncertainties with the impacts methods used. Contingent valuation, for example, is based on Western values of labor productivity. "Approaches like these run into problems because they are clearly income biased and relate to the labor productivity of an economy. While conventional, these approaches run the risk of reinforcing the idea that economists only value people in terms of their economic rather than social roles" (O'Riordan, 1995: 38). These approaches consider all monetized amounts equally even though a person with few monetary resources would be less willing to value environmental quality highly. This approach also ignores the responsibility for environmental degradation, or the polluter pays principle, while using willingness to pay as its basis for analysis.

Cost/benefit analysis is also questionable. Byrne (1987) identified that three analytic assumptions are required to conduct cost/benefit analysis: social problems are independent and bounded in scope; alternative solutions for problems are commensurable and finite; and objective values exist for measuring the cost of problems and the benefit of solutions (Byrne, 1987: 85). The first assumption is required in order to make calculations of social phenomena for it provides closure to the calculations. The second assumption ignores social preference for varying alternative solutions and is also needed for assessment calculus. Similarly, the last assumption assumes preferences can be quantified and ranked. These assumptions, although necessary to quantify social phenomena, are clearly inaccurate, and less than certain, of their portrayal of interdependent, intergenerational and diverse nature of social relations.

Uncertain science and inadequate impacts methods are handed over to policy 'wonks' who transform the incomplete and flawed data to fit a monetized management system. The economics-based impacts iteration, like the GCM-based science iteration, magnifies the cascading uncertainty. Climate change policy inherits this information and is left to sift it out. But even with certain science and impacts assessments, policy and politics use other criteria - consistent with democratic governance - as the basis for decision-making.

Climate Change Policy - Democratic Governance

Once an issue enters the policy realm, the science and impacts work gives way to the necessity of making recommendations based on incomplete and uncertain information. The decision to implement policy with an uncertain foundation is made by inflating the available information with normative significance. Thus the policy process seeks normative purpose where policy is passed and pursued with determined intent. Whether it is environmental protection, social progress or self-interested political power, the intent distorts the information gathered from the science and impacts communities. The certainty of the science and impacts work, then, may be irrelevant if it does not support the efficacy at achieving its political purpose. Climate change abatement ultimately comes down to this process. No climate change agenda will be implemented without its application through the political process.

Although each participating country has a unique political process, it is instructive to look at how this process works in one country, the United States. The United States' political process is viewed by the rest of the humanity as the following: isolated, not related to the rest of humanity; morally and ethically idealistic, can do no wrong; impatient; in want of quick returns to policy; superior, we are the best; a-historical where all is judged by its possibility; and; ill-prepared, a tendency to simplify issues (Wiarda, 1996: 40-4).

These tendencies press the political process at all levels. The executive branch of government is charged with carrying out policy, but the Constitution puts enormous limits on American presidents to balance power with the Congress while being accountable to the citizens. Policy approval then requires that the president use all the levers of influence they have. To be effective, a president must lobby, cajole and convince in this highly politicized environment making it hard to accept climate change policy that is free of political intent.

The same holds for the legislative branch of government. The 535 people in the Congress, along with several thousand staff people, are politically ambitious and motivated to get their agenda implemeted. The result is policy that is run by powerful committees, fragmented, short-ranged and highly partisan as strong party affiliation gets politicians ahead within the parties (Wiarda, 1996: 170). In all, "The separation of powers between the executive and the legislative branches, coupled with the bicameral structure of Congress and the decentralization of authority among numerous committees, further complicates the negotiations necessary to reach agreement on a consequential issue like global warming" (Skolnikoff, 1999:19).

It can be seen that the American political process is intensely politicized. Policy is often enacted because of influence and these influences manipulate evidence to suit their interests, to try to maintain the status quo or develop a new advantage. Climate change policy will have to battle its way through this structure of competing interests, "each having turf to defend or expand and each with a limited vision of the national interest" (Skolnikoff, 1999: 18). Climate change will increasingly be exposed to many of these varied interests arguing for the costs to be borne by someone else or that global warming is not happening.

This is the political nature of the contemporary form of democratic governance. Democratic governance remains a ubiquitous virtue but has been diminished by the adherence to economic interest and economic efficiency of an administrative state. Therefore, the temptation exists to de-politicize the issue. But to circumvent this process is to diminish democracy by further reducing the active influence of the citizenry, however distorted. As Byrne (1987) asks, if democratic governance is excluded:

> what is left of the idea of citizen? Little more than a glorified notion of consumer [and] governance a consumption good. Citizens decide whether and to what degree they are satisfied with the products of governance, but they have no responsibility for the production of governance or even overseeing its production (Byrne, 1987: 79).

Governance becomes the relative additions and subtractions of economic utility relieving the state of cumbersome democratic responsibility. The value of decisions arrived at democratically is discarded without the inclusion of the political process. Therefore, as messy as it is, this iteration must not be diminished.

CONCLUSION

Thus, the relationship between climate change science, impacts and policy remains a series of incompatible links. The resulting cascading uncertainty compels scientists, researchers and policy-makers to circumvent the most difficult aspect - to include democratic governance. Decreasing the number of stakeholders would provide for the most efficient process of climate change mitigation. This solution promotes cross-disciplinary 'experts' that conduct science and economic analysis for policy. It must be concluded that basing climate change policy on least-cost criteria and conducting science for policy is socially harmful and devastating to the scientific foundation of climate change policy. These are considered in turn:

First, the science-policy process supports the application of ever-expanding quantification and monetization of physical and life processes through prescriptive and administrative policy technique, and diminishes human processes in the pursuit of efficiency. The inclination is to circumvent the inefficiency of the political process with efficiency technique "as a viable alternative to politics" (Byrne, 1987: 71). Economic modeling is seen as the efficient method to decide questions of power and conflict and to displace the irrationality of politics. The models are unquestioned because of their basis in the legitimacy of reason and economic efficiency.

Ellul (1964) tirelessly defines the characterology of such a society designed around efficiency. He suggests these forces compel society to search for only 'one best way'; the process is self-augmenting; it necessitates all parts of society to come in-line; if a more efficient process exists, it is employed; efficiency collapses the non-efficient; all else is subjective to the objective nature of efficiency; and, this process is autonomous (Ellul, 1964: 80-134). Prescriptive policy based on economic efficiency alone will contribute to the process Ellul outlines. The active input from the citizenry curbs the preeminence of efficiency. Policy based solely on reason and efficiency displaces human characteristics that make up culture, and culture gives purpose to living, no matter how unreasonable and inefficient.

Second, should scientific research designed for policy be pursued? The answer argued here is no. The lack of political purpose is what makes science credible, as scientists are most influential when they do not strive for influence. The science of climate change must maintain this integrity and objectivity. Credible science is essential because it is the basis of climate change policy that will ultimately have to be accepted by policy-makers and the public. The intent of science should remain inquiry, not power. Credible science "is not in its power, but in its realization of its limits" (Price, 1965: 111). In such a climate, politicians will have to be resolved to make decisions without perfect knowledge because credible science will always dissent from attempting to claim perfect knowledge. Even so, science should not rely on politics for the climate change questions to pursue - it violates "the ethos of independent analysis" (O'Riordan, 1995: 35). Credible science searches for 'truth' at the boundaries of knowledge, not where it has already been defined.

These are the fundamentals that make science legitimate. The policy and impacts communities can respect the independence of science when it does not attempt to dictate purpose. Only then can science be the basis of objective criticism because it claims no power. Developing climate change science for policy would undermine this authority. Science designed for policy transforms science into trans-science where the rules of science are greatly modified by social and political forces.

A climate change policy process that adheres to the legitimizing principles of Western civilization maintains scientific and impact credibility tempered by the politics of democracy. This requires that democratic governance be upheld in the face of temptations to conduct science for policy and efficiency-oriented impact methods. The various iterations of the climate change science-policy process adhere to a particular legitimacy. To circumvent these may lead to a loss of legitimacy of all iterations - a loss of the credibility of science, and legislation that is prescriptive against the wills of democracy.

To maintain the foundations of legitimacy in the climate change policy process "necessitates communication in a language and through forms of analysis that the various groups and interests that make up the body politic can understand and appreciate" (O'Riordan, 1995: 39). To comprehend the gaps inherent in the understanding of climate change at these different levels, there is a need to improve the capacity for communication between them. The innate characteristics of science, impacts and policy need to be understood within each other's framework. Better understanding of the foundations of the iterations, the legitimizing roles they play in society and the inherent uncertainties they produce will improve the communication between them so that they can be mutually supportive. ❑

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Communicating with the Media: A Scientist's Perspective

David Viner

ABSTRACT

Within the context of the UK there is immense public interest in the weather, this coupled with the increasing awareness of global climate change has meant that the media is increasingly demanding on climate scientists for soundbites, headlines or longer takes, this has often led to conflict, misunderstanding and a breakdown of trust between parties.

The presentation will outline the way in which an individual scientist has dealt with the media during their career. This will be presented in a way in which information can be provided to both the scientific and media communities about the positive and negative aspects of communicating with the media. This will be undertaken by presenting the personal experiences and views of a scientist who has given over 100 interviews for international newspapers; magazines; live television and radio; and recorded television and radio.

The presentation will cover the reasons why scientists talk to the media and the reasons why scientists do not talk to the media. The advantages of communicating with the media will be outlined. Reasons why the media can sometimes be responsible for not being entirely reliable will be given.

The conclusions will outline to both the scientists and media alike the ways in which working relationships and practices can be improved so that both parties can develop and enhance their mutual benefits and understanding. ❑

The Communication and Utilization of Research-Based Information: Moving Within and Beyond (Climate) Impact Assessments

Roger Pulwarty and Stewart Cohen

ABSTRACT

Societal impacts of changing environments (climatic, ecological, pedological) can be categorized as having primary or direct effects (increased soil moisture, loss of life, crop and building damage etc.), secondary or indirect effects (displacement, illness) and, higher order or systemic effects (debt, loss of livelihood). Vulnerability to such events is constructed from: (1) the timing, magnitude, spatial extent, and duration of the physical hazard i.e. risk; (2) exposure in regions of risk e.g. population, property; and, (3) factors that pre-condition the degree of impact and the capacity to respond and recover. The call for better articulated decision support and services components of "assessments" is rising on par with more traditional axes of assessments i.e., characterizing the integrated physical system and its social and environmental impacts. The expectation is that increasing the rate at which policy makers and resource managers acquire knowledge about environment-society interactions will result in improvements in the quality of public and private decisions (a decidedly idealized view). Much recent work has shown that this expectation is most difficult to meet when decision stakes are high, uncertainty is great, technologies are new, experience is limited, and there are unequal distributions of burdens and benefits.

In this paper we review generalized frames of reference on the use of climate information identified in independent studies undertaken by the authors in different river basins of North America. As shown in these (and other) studies, researchers, policy-makers and practitioners (public and private) operate on different time-lines, use different languages, and respond to different problem definitions and incentives. How and when information is used or influence decision-making is directly and indirectly affected by a variety of factors (e.g. trust, credibility, appearance of "manipulation" etc.). It is not dominated by one set of factors (e.g. format),or, defined by a single perspective (e.g. organizational, rational actor, or communications perspective). The process of communication is thus increasingly recognized to be complex, transactional and heavily dependent on the potential user's pre-existing knowledge, beliefs and experiences. In addition, policy-makers and operations managers feel that the information provided is, for the most part, not sensitive to the unique situations in which they must act.

We outline differing approaches to risk communication and their associated assumptions, identify similarities and differences in communicating short term climate forecasts and climate change scenarios, and identify guidelines for overcoming barriers to symmetric interaction between researchers and decision-makers. Communication between these groups can be enhanced through one-on-one and small group dialogues with decisive participants on impacts and adaptive responses to climate information products (ENSO forecasts, climate change scenarios), and to first-order impacts scenarios (streamflow, fire index). We believe that since weather/climate issues are complex, uncertain, but potentially significant for humanity, increased attention needs to be given to communication efforts with individuals and small groups. ❑

On the Role of Research Programmes in Climate Change Communication. Experiences from the Dutch National Research Programme on Global Air Pollution and Climate Change

Karin Obdeijn and Marcel Kok

This paper explores the possible role of research programmes in climate change communication. The communication strategy in the Dutch NRPis described . After that the step is made to the role research programmes can play in bridging the gap between science, policy and society. Four different stages are distinguished in the progress of any research programme and we elaborate possible ways to shape the dialogue in these phases. Three dialogue projects within NRP are then described and some conclusions are drawn.

INTRODUCTION

Research is increasingly being funded in the form of problem oriented research programmes, which combine scientific and societal goals. (Human induced) climate change is one such problem put firmly on the research agenda in many countries in the last 20 years. One of the reasons for organising research in the form of programmes is that, compared to a collection of single projects with no overarching structure, programmes are expected to confer added value in terms of communication and enhanced use of research outcomes. Communication of research findings can benefit from another reason to organise (climate) research in programmes, viz., working towards integration and synthesis of scientific results (be it within national research programmes or international programmes such as IPCC and IGBP, IHDP and WCRP). Without such integrative effort results of climate change research (which is essentially an interdisciplinary endeavour) often remains too scattered, with only piecemeal availability, to become useful to stakeholders in their decision making. This problem has also been recognised in other environmental decision making processes in the Netherlands (van der Aa, 2000).

The communication between science and society is not unproblematic. Agenda 21 notes that 'often there is a communication gap amongst scientists, policy makers and the public at large'. Others say it is even worse, noting that there is often a discrepancy between the knowledge needs of stakeholders and the knowledge produced by science (Hisschemöller et al., 1998; in 't Veld (red.), 2000). Improvements on the science-policy interface are therefore often looked for by means of intermediary organisations, improved communication etc. In our opinion also research programmes can help to bridge these gaps. The goal of this paper is to explore the possible role of research programmes in climate change communication. The general point of departure in this paper is that extra efforts, initiatives and activities are needed to enhance the communication between science, policy and society, and to go one step further and enhance real dialogues.

This paper is based on experiences gained within the Dutch National Research Programme on Global Air Pollution and Climate Change (NRP, see also the text box) and furthermore on experiences in other research programmes in Europe (Switzerland, UK).

There are a few reasons that make it extra relevant to take a closer look at the role of research programmes on climate change communication:

- A broader tendency which can be recognised in European science policy that there is a increasingly emphasis on the need for research to serve the needs from society (Scott, 2000).
- Increasing attention (at least in the Netherlands) to new types of policy making such as interactive policy

The Dutch National Research Programme on Global Air Pollution and Climate Change (NRP), http://www.nop.nl
NRP is a strategic research programme on climate change issues. The programme is organised into four themes: the climate systems, vulnerability of natural and societal systems to climate change, societal causes and solutions and integrated assessment. NRP has the following goals:

- to strengthen and support the Dutch climate policy, in national and international contexts;
- to support an active communication about climate change issues between science, policy and society;
- to strengthen the Dutch research structure on climate change

The first phase of the programme started in 1989; the currently running second phase started in 1995 and will last until 2001 and over 80 research projects will be carried out in this period with a total budget of about 20 million ECU. Currently preparations are starting in train for a third phase of the programme.

development, as opposed to a more linear approach towards policy development under the assumption that more knowledge leads to better decisions. Interactive policy development provides an opportunity for research programmes, especially in the early phases of policy development when problem structuring takes place.

- Communication is especially important in the climate change domain, where science plays an important role in framing the issues and pushes climate change forward on the political agenda (consider the influence of the IPCC-reports, for instance). At the same time the role of science is highly disputed in issues such as climate change, which combine a high level of uncertainties, different values, high stakes and hard political pressure. This is made clear by post-normal science (Functowitz and Ravetz, 1993), which suggests extended peer review as a solution to handle such post-normal situations.

COMMUNICATING CLIMATE SCIENCE

This section considers the special nature of communicating climate change issues. Particular attention is paid to the role of research programmes as a 'scientific organisation'. Scott (2000), in a review of the literature of effective communication of science, summarises the following important elements of communication. Scientific fields that practice effective dissemination:

- have clear statements of goals, are relevant to practitioners and deal with variables they can do something about and can be built into pending decisions,
- communicate frequently and across greater distances and/or institutional boundaries,
- have the main problem broadly anchored; that is, relate clearly to a great number of other more familiar issues that are of interest to key audiences,
- manage to popularise principal issues (clear language!) of their results and find suitable forums for communication via different communication channels,
- create a sense of ownership among practitioners of the results of research.

NRPs Communication Strategy

The key challenge is: how can one get climate considerations 'between the ears', not only of the public at large, but especially of all those who are contributing to the greenhouse effect and whose help is required to solve the problem or those who may be confronted with the consequences of climate change. A basic problem is that causing the problem and experiencing the impacts of global warming are unevenly distributed. Some groups who contribute to global warming will not feel the impacts, others will experience the effects of global warming. Only a few of the sectors are responsible for emitting greenhouse gases, may also feel the urge to prepare themselves for the expected climate change impacts - the agricultural sector, for instance.

The most important goal the NRP seeks to achieve is that stakeholders are made aware of their contribution to the climate problem, know the possible climate change impacts for their sector and are aware of mitigation options. Through the transfer of research results, the NRP also aims to stimulate the societal debate between researchers, policymakers and society in order to increase knowledge of the climate problem among the target groups.

Since society as a whole is broadly constituted, one must choose at which one whishes to aim. The programme's communication strategy is therefore directed at a number of clearly defined subgroups and sectors within Dutch society.

The NRP does not consider its task as making the Dutch public as a whole aware of the climate change problem. Increasing public awareness of the climate problem is considered primarily the task for the government and NGOs, rather than for a research programme. Furthermore, the NRP has neither the financial means nor the capacity to communicate by means of expensive public media campaigns. Nevertheless we try to make research outcomes accessible to a large public.

The primary target groups for communication are:
- national policymakers at appropriate ministries (namely Environment, Nature and Agriculture Transport and Public Water Works and Economic Affairs), politicians and local policy makers;
- stakeholders (institutions and sector organisations, business, NGOs etc. which are active in the field of nature, environment, agriculture, energy, industry, transport and water-management);
- intermediate persons and groups (news and science editors in the daily press, radio and television programmes, science press and governmental press).

Through these last group a substantial part of the Dutch public can be reached, viz. the interested reader and television watcher.

Communication Tools
The Programme Office uses several communications tools:
- Newsletter CHANGE: Bi-monthly publication that casts a spotlight on NRP research. CHANGE contains articles about global change research and about policy issues related to global change. CHANGE is also open for (discussion) papers from people outside the NRP.
- Web site (www.nop.nl): The NRP web site contains information on climate change, on the programme, the organisation, climate change research in the Netherlands, research projects, publications and activities on climate change, the electronic issue of the newsletter CHANGE and fact sheets. Right now the site is being renewed.
- Research reports: A final report is published of each research project that has been finished and approved by peer reviewers.
- Brochures: The Programme Office has published several brochures and annual reports for policymakers and stakeholders, with information on the programme, the research topics and the organisation of the NRP fact sheets. For instance a position paper was published for the World Water Forum in the Hague, march 2000.
- Fact sheets: Reports of research projects often are not attractive for non-scientists readers who don't wish to know all methodological details. Therefore the programme office has published a series of fact sheets. These give brief information and facts on the findings of a particular research project or theme, which is thought to be relevant for one or more sectors.
- Press releases: The Programme Office occasionally invites the press to give an actual state of the art on the research programme and running projects or sends out press releases to ask attention for new insights.
- Briefings of climate policy makers: The Programme Office regularly co-ordinates with a special inter-ministerial task force on the implementation of the Kyoto protocol, which research projects can make a presentation to support the work of this task force.
- Workshops, round tables, conferences: The most effective communication takes place when people interact.

The Programme Office therefore regularly organises workshops, or stimulates research teams to organise workshops, with both researchers, policymakers and stakeholders. This results in a broad interaction about different aspects of the climate problem.

Most of the outreach tools are not limited to a single target group, with the exception of the press conferences and press releases, which only mean to inform the Dutch press. The newsletter, the NRP-web site, research-reports, brochures, fact sheets and workshops are used to inform both policymakers and stakeholders. Of course, not all stakeholders are interested in the same information, so the NRP tries to define which results might of interest for which sectors and target groups ('product market combinations'). Therefore several sectors are discerned when communicating: nature, agriculture, environment, transport, energy, industry, water-management and human health.

FROM SCIENCE COMMUNICATION TO ENHANCING DIALOGUES

The previous section described different means of communication which are used within NRP, stressing the importance of communication as a mutual exchange and flow of information, ideas, values, is mentioned. Basically it is a precondition if one is to succeed getting climate considerations 'between the ears' of stakeholders.

The first challenge, then, is to involve researchers in such communication and dialogue with stakeholders. This can sometimes be difficult since such activities are basically not rewarded in the traditional disciplinary academic system. The counter argument to motivate researchers to get involved in such dialogues, is that stakeholders are experts in their own domain and often have a lot useful knowledge/experiences/insights to offer, from which researchers can also benefit.

There is a noticeable trend within different parts of environmental and climate change research, to develop new relationships between science, policy and society. The assumption is that a linkage of knowledge production and policy development in environmental policy results in improvements in decision making (in 't Veld en Verhey, 2000).

In the UK, in the ESRC Global Environmental Change Programme experiments took place with *'interactive social science'* (Scott, 2000). Within the Swiss Priority Programme Environment it was tried to implement the idea of*'trans-disciplinary science'* (Gibbons, 1994; Defila and Di Giulio, 1999). Trans-disciplinarity denotes a special form of inter-disciplinary research that involves practitioners from beyond the realm of science. Knowledge production thus takes place in the context of application. Trans-disciplinary science, in our opinion, is closely related to the idea of *post-normal science and extended peer review*. Both approaches emphasise a more reflexive way of knowledge production in which an important role is seen for a broader group of (non-scientific) stakeholders and lay people to reflect the plurality of paradigms in the policy arena. Within NRP some steps are taken in these directions, but involvement of stakeholders in different phases of a next phase of a climate programme can be pushed one step further.

In the latter part of this section we will explore how research programmes can contribute to linking the scientific arena and the policy arena in a fruitful way. We distinguish four different stages in the development of any research programme and will elaborate the possible ways to shape the dialogue in these phases.

The four stages we see are the programming phase, the phase of research in progress, the integration phase and the outreach phase. They should not be seen as clearly divided phases; rather, they will overlap. Outreach, especially, is a continuous process which also takes place during the other phases. But nevertheless, it makes sense to look at it separately and it needs most attention when results are available.

Furthermore, we suggest to look at these phase in an iterative mode: programming research is not a linear process, it includes many feedbacks. For instance, involvement of stakeholders in a participative integrated assessment project at the end a research programme will enhance the formulation of a societally relevant research questions which can be used in a next stage of a research programme.

1. *Programming phase*. The involvement of stakeholders in formulating research questions is a major point of attention in this phase. To enhance the usability and the actual use of knowledge in political decision making,

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Table 1 Summary of main points of attention and tools in different phases of a research programme when designing the science, policy, society dialogue

Phase	*Main points of attention*	*'Tools'*
Programming phase	Articulation of demand side	- Involvement of stakeholders in programming activities such as workshops, interviews, programming committees, programming studies etc. - use outcomes of participative integrated assessments
	Extended peer review as opposed to scientific review	- inclusion of non-scientific peers/stakeholders in review procedures of proposals
Research in progress	Link expertise from outsiders with the research project Increase ownership of results outcomes amongst potential users	- advisory groups - presentations - workshops - inclusions of practitioners in research projects
Integration phase	Translation of specialised and scattered research into usable knowledge. Problem oriented approach. Development of tools for integration and decision support (models, workshop methods etc.)	- assessments (within research programme or internationally in IPCC, IGBP etc.) - involvement of stakeholders in integrated assessment (demand driven). - Development of models, methods, flexible decision support tools in collaboration with future users
Outreach phase	Information about research in progress and research results. Raise awareness.	- workshops, round tables, conferences - web site - newsletter, fact sheets, reports, targeted brochures etc.

one needs more attention to the articulation of the demand side (Hisschemoller et al. (1998), in 't Veld en Verhey, 2000)). A second task, related to the previous, is to develop systems of extended peer review (as suggested by Functowitz and Ravetz) which may also imply the inclusion of stakeholders in the review of research proposals

2. *Research in progress*. This phase is about linking stakeholders and scientists to improve the quality of research. Trans-disciplinary approaches suggests to include stakeholders in the research project as such, but also other ways can be found to have researchers benefit from expertise from practitioners in the field.
3. *Integration phase*: The translation from mainly specialised but often scattered research into usable knowledge takes place during this phase; by means of assessments, for example. The Global Environmental Assessment Project (Harvard) shows the importance of looking at assessments not only as a report but also as a process. Structured dialogues as part of (integrated) assessments can guarantee a framing of problems in a way that is relevant for stakeholders (demand driven / problem oriented approach). The fact that especially this phase requires the scientific development of dedicated tools for integration and decision support merits extra attention.
4. *Outreach phase:* The communication of research is important in all phases of a research programme, but deserves most attention in the final phases of research (see previous section).

DIALOGUES WITHIN NRP

Within climate change research *'integrated assessment'* (IA)(Rotmans and Dowlatabadi, 1998) has developed rapidly over the last decade as an approach to support climate change decision making. IA is an approach that combines analytical and participatory methods to come to integrated analysis. IA brings together science and stakeholders in exploring scientific insights to policy questions.

In this section we briefly describe three NRP integrated assessment projects, which form a major contribution to the structured dialogues between science, policy and society initiated by the NRP:

- Policy Options Addressing the Greenhouse Effect (Klabbers et al., 1994; Vellinga et al., 1995, Hisschemoller et al. 1995, Zwerver en Kok, 199)
- the Delft process (van Dalen et al., 1998, Berk et al., 1998)
- Climate OptiOns for the Long term (COOL) (Berk et al., 1999).

We give only a concise description of the projects and some interesting outcomes of the projects. At the end of this section we will briefly go into the problems and challenges of incorporating such projects within a research programme.

Policy Options Addressing the Greenhouse Effect

This project was carried out between 1992-1994, three years after the start of the NRP. A period in which the actual existence of human influence on the climate was far more contested than it is nowadays. The goal of this project was to enhance the dialogue between different actors in society about the climate problem, to articulate the different perceptions about the climate problem in Dutch society and to explore different policy options for climate policy development. The project consisted of a series of workshops and roundtables with policy makers, scientists and representatives form industry and business and civil society. The project resulted in the identification of the following five perspectives on the climate problem within the Netherlands:

¥*No regrets*: a valuable policy, even with no sign of climate policy;
- *Least regrets*: no regrets plus anticipatory policy to cope with risks;
- *Acceleration*: accelerating forces within society to reinforce positive changes towards sustainable development;
- *Technological innovation*: technology as a sufficient opportunity to balance societal needs with the carrying capacity of the natural environment;
- *Institutional cultural change*: societal, cultural and institutional changes as ultimate solution to sustainable development, including climate change.

The project identified preferred actions, technologies and related research questions for all these five perspectives, with a time horizon of 2025. By some policy makers it was stated after the project was finalised that the project was not particularly useful to their work. An interesting explanation for this may be offered by Caplan, (1975), who points at the distinction between instrumental utilisation and conceptual utilisation of outcomes of research, the latter of which he considered more significant. Evaluation by the project team indicates indeed more conceptual utilisation, but no independent evaluation of this project is available.

The Delft Process: experiences with a dialogue between policy makers and global modellers

Between 1995 and 1997 a series of 5 two-day meetings were held in the city of Delft in the Netherlands with global modellers (in this case the IMAGE-team) to support international negotiations. IMAGE 2 is a global integrated assessment model (IAM) of the Netherlands Institute for Public Health and the Environment; its is the main IAM funded by the NRP (Alcamo et al., 1998). IMAGE 2 was developed into a scientific credible model during the first phase of the NRP and around 1994 it was felt possible to use the model for policy analysis and focus it on issues being discussed in the context of the FCCC in the run up to CoP-3 in Kyoto. The workshops provided participants an opportunity to discuss research findings in a context away from the ongoing negotiations and to address new questions to the modellers. An interesting result of this process was that it resulted in a more policy relevant framing of the problems at hand during that time. The so-called 'safe-landing approach' was developed, which relates questions about the long term risks to short term policy actions and results in safe emission corridors up to 2010 (Alcamo and Kreileman, 1996). This safe-landing approach was translated by the modellers into a flexible and communicative policy support computer tool based on IMAGE outcomes. This tool can be used for quick analyses during the meetings (which is not possible with IMAGE that requires a long time period for calculating a certain scenario).

After Kyoto this process was continued in collaboration with Kassel (Germany) university and two additional workshops were funded by the NRP and the German government.

Climate *O*pti*O*ns for the *L*ong term (COOL)

To contribute to successful closure of the second phase of NRP, this project started in 1999 and will last until 2001. COOL aims to explore options for far reaching greenhouse gas emissions in the Netherlands in an international context. In a one year dialogue several groups, both Dutch and international stakeholders and policy makers, explore the possibility of reaching -80% greenhouse gas emissions in 2050. When discussing the focus of this project, the Ministry of Environment made clear that they need ideas about how climate change policies beyond Kyoto and the first budget period may look like. The options how to reach such long term emission reduction targets are now explored within four sector groups within the Netherlands (industry and energy, transport, agriculture and build environment), within two sector groups on the European level (transport, industry and energy) and on the global / FCCC level (which is in a sense a continuation of the Delft process within the COOL).

Besides COOL, an impact assessment was started early 2000. This project will result in an overview of the major impacts of climate change and possible adaptation strategies for different sectors in the Netherlands. Stakeholder dialogue, partly through experiments with an internet method, will be an important part of this project as well.

Incorporation of dialogue projects in a research programme

Based on our experiences within NRP we would like to mention the following aspects which need attention when initiating and carrying dialogue projects within a research programme:

- Bring potential users and research team in a early phase in close contact;
- Avoid mono-disciplinary 'ownership' of the process and involve multiple scientific perspectives in the process;
- Make sure that dialogue projects are fully embedded in the programme to ensure optimal use of research outcomes within other parts of the programme;

- Create mechanisms to enable other projects to contribute to such dialogues (opportunities to comment on project design and (intermediary) results, present own research outcomes);
- Provide financial compensation to other projects which you like to contribute to the dialogues;
- Be aware of differences in timing and availability of results.

CONCLUSIONS

We draw the following conclusions on future roles of research programmes in communicating climate change research and enhancing the dialogue between science, policy and society:

- Research programmes can be seen as a possible *platform* for communication and dialogue, link the scientific and policy arenas. They can pick up tasks which are for individual research projects often hard to realise.
- Ideally this should be seen as a *continuous and long term process*, since investing in such dialogues is also about creating trust and credibility between participants.
- The role of research programmes should be looked at in a *iterative way*. Such iterations should be build in the research programme explicitly. The sort of outcomes of strategic research demand '*translations*' (through assessments, interpretation by experts etc.).
- Within different phases of research programmes, the dialogue will look different, it will have other goals and will be instrumented accordingly (see table 1).
- The three projects described reflect the necessity while the climate agenda moves forward, to identify specific niches on the science-policy interface for initiating dialogues in the form of projects.
- Incorporating dialogue projects in a research programme poses a challenge in itself for research management. We have mentioned a few aspects that deserve attention. ❑

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Session C3

CIVIC ENGAGEMENT 2: LESSONS FROM OTHER PARTICIPATORY PROCESSES

Congruence of Barriers to Public Involvement in Local Climate Change Initiatives and Environmental Assessment Processes
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Learning to Engage: Experiences with Civic Engagement in Citizens
Miriam Wyman
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Assessing Adaptive Capacity in the Coastal Zone: A Case Study of the St. Croix Estuary Project
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Congruence of Barriers to Public Involvement in Local Climate Change Initiatives and Environmental Assessment Processes

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Public involvement is an indispensable condition of local climate change initiatives but experiences from other resource and environmental management contexts indicate that policy makers could reasonably expect formidable barriers to widespread public involvement. This paper reviews selected constraints on public involvement in environmental assessment processes and examines their relevance to local climate change initiatives. Methods used were document review, qualitative interviews, coding, and thematic sorting. Consideration of the topics and themes that emerged illuminated potential responses applicable to climate change, including involvement in normative and operational levels of planning and adoption of critical or transformative approaches to adult education and learning.

INTRODUCTION

Public education and outreach are recognized internationally as important elements of policy responses to climate change dilemmas (United Nations 1992, article 6; 1997, article 10). Canada's approach to public education and outreach emphasizes local initiatives that equip and motivate citizens to reduce greenhouse gas emissions (Public Education and Outreach Issue Table 1999). Public involvement is a sine qua non of local initiatives but experiences from other resource and environmental management contexts indicate that climate change policy makers could reasonably expect formidable barriers to broad-based and effective public involvement. This paper examines barriers in the context of environmental assessment (EA) and considers their relevance to a discussion of local education and outreach initiatives respecting climate change.

In EA, public involvement typically refers to participation by interested publics in planning and decision-making associated with a proposed undertaking (e.g., Praxis 1988; Roberts 1995). In the context of local climate change initiatives, public involvement usually focuses on participation in the service ultimately provided as a result of an initiative. This is an important conceptual distinction that clarified our comparison of EA processes and local climate change initiatives but, in the end, was largely trivial in nature. As the ensuing discussion reveals, lessons learned from EA were directly applicable in the climate change context.

METHODS

The primary data collection methods were document reviews and semi-structured, qualitative interviews. Much of the data were drawn from a case study of the environmental assessments conducted in the new Maple Leaf hog processing facility in Brandon, Manitoba. 27 interviews were held with members of key publics in the Maple Leaf case, including proponents, federal and provincial regulators, non-governmental organizations that were critical of the project, non-governmental organizations that were supportive of the project, the business sector, the news media, academia, and unaffiliated individuals. Interviews were also held with Brandon residents who did not participate actively in the case. The case-specific data were augmented through 19 interviews with senior EA officials in eight Canadian provinces and the federal government of Canada and with officials with two environmental non-governmental organizations (ENGOs) in Manitoba. In all instances, interview participants were asked specifically why some people refrain from participating in environmental assessment processes. Interview data were analyzed using NUD*IST 4, with grounded categories being grouped into broader themes derived from external concepts and theories.

Finally, a comparative analysis was done in which the EA data were considered in the context of local education and outreach initiatives respecting climate change. To help ground the discussion, the EA data were compared to a specific example of a local climate change education and outreach initiative, rather than to such initiatives generally. The specific project studied was the Green Commuting Project, which promotes alternatives to commuting via single-occupancy vehicles. To assist with the analysis, three interviews were held with project staff.

MAPLE LEAF

The Maple Leaf case involved the construction of a $120 million hog slaughtering and processing facility and a $13.5 million wastewater treatment plant in Brandon, Manitoba (Fallding 1999; McNeill 1999). The slaughterhouse is owned by Toronto-based Maple Leaf Foods and the treatment plant is owned by the City of Brandon, Manitoba's second largest city (Statistics Canada 1996). Both the slaughterhouse and the wastewater treatment projects were subject to environmental assessments under Manitoba's Environment Act (Manitoba Environment 1991). Public hearings into the construction and operation of the projects were not conducted by Manitoba Environment but the EAs did include other opportunities for public involvement. Although there was some debate over the extent and quality of these opportunities, they were quite typical of public involvement exercises in Canadian EA processes, e.g., comment periods, appeal procedures, open houses, and information meetings.

THE GREEN COMMUTING PROJECT

The Green Commuting Project is an initiative of Resource Conservation Manitoba, a Winnipeg-based ENGO. The project focuses on promoting increased awareness and action to reduce greenhouse gas emissions, and on healthy lifestyle choices associated with active transportation (Green Commuting Project 2000; Stuart 2000). The particular service of the Green Commuting Project that was the focus of this research was the Winnipeg Commuter Challenge. The commuter challenge is an event that occurs nationally during Environment Week (June 5-9) and has taken place in Toronto, Ottawa and Calgary for years. In 2000, project staff organized Winnipeg's first commuter challenge and recruited participants in the private, public and nonprofit sectors. In the commuter challenge, organizations and individuals compete by scoring points for using alternative means of commuting, such as cycling, rollerblading, carpooling, walking and running.

SELECTED BARRIERS TO PUBLIC INVOLVEMENT

As noted earlier, interview participants were asked specifically why some people refrain from participating in EA processes. The reasons for nonparticipation fell into two primary categories: 'structural constraints' and 'individual constraints'. These categories, imposed on the data from conceptual frameworks adopted by the researchers, are not dichotomous and have numerous linkages between them. Structural constraints included barriers related to societal structures, encompassing institutional settings, economic arrangements, and legislative frameworks. Individual constraints included barriers related to an individual's perception of the project being considered as well as personal apprehensions regarding one's ability to participate in EA decision-making.

Within structural constraints, there were four secondary categories, three of which were subdivided into tertiary categories. The secondary categories were imposed on the data from conceptual or theoretical frameworks adopted by the researchers but the third order categories were grounded in the data, i.e., were based on ideas and words expressed by the interview participants. Within individual constraints, there were six secondary categories, four of which were subdivided into tertiary categories, and all of the second and third order categories were grounded in the data. Table 1, presents a complete list of the categories derived from the EA data.

Lessons drawn from the EA data are germane to public involvement in local climate change initiatives. First, the overall analytic framework, relying on a distinction between structural and individual constraints, is apposite to the climate change discussion. Second, many of the constraints identified from the EA context are pertinent to local climate change initiatives. The ensuing discussion explores this, focusing on the Green Commuting Project, but does not attempt a comprehensive review of the barriers derived from the EA data. Rather, selected barriers are described and their applicability to local climate change initiatives is examined. As well, the discussion cites relevant empirical evidence and secondary sources drawn from the EA and climate change literatures.

Involuntary Complexity

A recurring theme that emerged from the EA data was that people are too busy to participate in the civic life of the community because of the complexities and time pressures of modern living. We categorized this theme as a structural constraint and labeled it 'involuntary complexity', adopting notions from the voluntary simplicity movement, which advocates a simpler, less consumptive lifestyle (Elgin 1981). One interview participant expressed the idea this way, "A lot of people are busy in their daily lives or work or what have you, they just don't want to get involved." Another said, "They are typical Canadians. They are busy with their lives, family, jobs, friends." Yet another linked nonparticipation to the demands of consumer lifestyles:

> "People in Brandon are no different than elsewhere. They believe that the good life comes to them through acquisition and in that belief have entered into debts, work fulltime, or fulltime and a half, or double jobs. Now, both parents in families are working. ... The result of this is a very fast paced, very superficial, extremely stressful and competing society. Everybody is racing, racing, racing, racing, often mindlessly, reflexively, totally without reflection, totally without connection to anything that they even recognize as a value...and we say we value democracy, but we have created a configuration of power that scarcely permits it."

The central idea captured by involuntary complexity has been the subject of some attention in the EA literature. For example, Praxis (1988, 22) noted that, "all citizens have the right to choose not to participate. Some people choose just to participate in daily tasks of earning a living and caring for a family".

With respect to local climate change initiatives, involuntary complexity is a potentially serious constraint on public involvement. The same family, community, and work pressures that prevent individuals from taking part in EA and other civic activities could, presumably, also prevent them from participating in climate change initiatives (Yee 1999). This was confirmed in interviews with a staff member of the Green Commuting Project, who indicated that a major hurdle facing the project was the common perception that alternatives to commuting by single-occupancy vehicle are time consuming and inconvenient. This emphasis on time and convenience is explained by factors of involuntary complexity, as is recent research suggesting that, "telling Canadians to leave their car at home is not realistic" (Public Education and Outreach Issue Table 1998, 6).

As well as individuals, involuntary complexity could also affect gatekeepers, typically in middle management, of organizations that are critical to the success of local climate change initiatives. In trying to promote their services among employers, including government departments, crown corporations, and both small and large private firms, workers with the Green Commuting Project were frequently faced with obstacles associated with involuntary complexity:

> "The people that we were speaking to just did not seem to have the time to devote to something new."
>
> "These people are managers. Their job is to manage, not to do outreach. They do not see it as their problem – one woman said to me that, "my problem is when people are at work not how they get to work". She did not want another problem to deal with – she was managing her time. Managing time is the first barrier with these people."

Foregone Conclusion

Another important structural constraint emerging from the EA data was 'process deficiencies', which gathered those reasons for nonparticipation that stem from perceived shortcomings in the EA process. Obviously, some of the subcategories of process deficiencies are not applicable to local climate change initiatives because they are specific to environmental assessment, e.g., 'inadequate notice'. Others, however, are directly relevant to the discussion, such as 'foregone conclusion', which captured the idea that people refrain from participating because they believe their input will not make a difference. Comments from interview participants reflecting this belief included:

> "My view was that I think that things were already decided and participating isn't going to make a difference. So, you know, i could go and blow off steam but if the end result is going to be the same no matter what I do, I think that is a waste of effort."

> "I think that most of the community sees the Maple Leaf plant as a fait accompli, not something that their participation can really influence, whether they're in favour of it or not."

The foregone conclusion factor has been discussed in the EA literature. For example, Praxis (1988, 21) noted that people will not participate, or choose to participate in other ways, if they "believe that the decision is already made". Similarly, Petts (1999, 172) noted increased alienation when publics feel "that decisions are made before they are asked to participate". Finally, a number of studies reported indirect empirical evidence that public involvement is constrained when the dominant parties in an EA are not open to alternative perspectives (e.g., Richardson et al. 1993; Kagonge 1995; Regnier and Penna 1996; Stevenson 1996; Nikiforuk 1997).

In the context of local climate change initiatives, foregone conclusion is pertinent to planning and decision-making but is likely more applicable to public acceptance or adoption of climate change services, such as green commuting options. There is research that indicates that Canadians feel helpless towards the effects of climate change and do not see themselves as part of the solution (Andrey and Hachey 1995; Public Education and Outreach Issue Table 1998). This is consistent with experiences at the Green Commuting Project where one staff member indicated:

> "In addition to the problems of people thinking that the climate is changing and there is little we can do about it, I hear that the solutions are impossible. People do not think that it is possible to change commuter habits."

Project staff also revealed a cynicism towards public policy efforts in the area of climate change that could reflect the views of inactive publics and is linked to the foregone conclusion theme:

> "[The federal government] brought folks to the table but it sure looks like everyone wants to avoid responsibility. The trucking association's response is to make trucks longer – not to try and get some trucks off the road. This just adds to the perception that nothing can be done. Yet there is lots that can be done – the government itself could do energy conservation in their own buildings – set an example and save money – but they don't".

Extremism

Yet another important structural constraint derived from the EA data was 'alienating dominant discourses', which refers to how the framing of discussions (e.g., setting agenda and terms of debates) could pose barriers to participation. An interesting subcategory with relevance to local climate change initiatives was 'extremism', which reflects suggestions from some interview participants that portrayal of project critics as extremists deterred self-defined moderate members of the public from becoming involved:

> "We were certainly painted by some of the media, including the Brandon Sun, and by city council or the mayor, as kind of being in the most despicable of categories, radicals, people who want to change things, people who aren't satisfied with and don't want progress. And, I think a certain amount of that that stuck to us and may have influenced people who might, I don't know, maybe this is paranoia, but might not want to be seen, you know, openly involved in something that we were associated with."

The notion of extremism as a barrier to broad public involvement has not been specifically discussed in the EA literature. However, Frideres et al. (1992), in their case study of the Keephills thermal power project in Alberta, provided empirical evidence of a related barrier, namely that the interests of active publics, such as ENGOs, may not be representative of the views of inactive publics. A cursory review of the climate change literature also failed to retrieve substantial evidence regarding extremism as a barrier, but data from the Green Commuting Project indicated that public perceptions of extremism could indeed constrain broad involvement in local climate change initiatives. Project staff commented:

> "We also have to live with the historic antipathy between environmental groups and industry. We went to [a large industrial establishment in Winnipeg] with our original concept. They have a large workforce, largely immigrant, and a huge parking lot. It was clear before even talking to them that they could have an industrial charter bus from the inner city to their site. They said they were not interested but we heard that one month after our visit they hired someone to look at transportation demand management. We worked hard to educate the people at [the company] through a number of meetings. I can only assume that when you offer to do a job for someone for free and they say no that they have some problem with the organization – they did not want us involved."

Technical Focus

Another subcategory of alienating dominant discourses with relevance to local climate change initiatives was 'technical focus', which pertains to how technical and scientific discourses are inaccessible to many members of the public and present barriers to widespread public involvement. Of course, technical and scientific discussions are necessary and desirable both in EA and implementation of public policy on climate change. However, if such discourses predominate and are compounded by other constraints, they present a formidable barrier to participation. The following comments from the EA data support this assertion:

> "[The documents] were not remotely understandable to someone without a technical background and I did okay as a [member of the media]...but I know that even other [members of the media] would go in and read them and kind of miss the point because they were written by scientists for scientists essentially..."

> "Also right up there [as a reason for nonparticipation] is the fact that much of the information is very technical and hard to understand."

Technical and scientific discourses and how they constrain public involvement in EA have been recognized in secondary sources (e.g., Praxis 1988; Smith 1993; Petts 1999) and established in a number of empirical studies (e.g., Frideres et al. 1992; Richardson et al. 1993; Regnier and Penna 1996; Sullivan et al. 1996). They have also been the subjects of scrutiny in the climate change literature. Andrey and Hachey (1995, 10) commented that, "Future climates are presented as scenarios, potential impacts as probabilities/risks/ranges, and human responses as true uncertainties. This type of language presents a major communication challenge". A dimension of climate change discourse, and resource and environmental management discourse generally (e.g., Carpenter 1995; Chociolko 1995), that is particularly problematic is the communication of scientific uncertainties. Dotto (2000) recently explored how difficulties in communicating uncertainties over climate change have contributed to delays in political action to reduce greenhouse gas emissions.

Evidence from the present study confirms the significance of barriers relating to overly technical information, but the most pressing problem could relate to communications from the federal government to front line workers involved in local climate change initiatives. A staff member from the Green Commuting Project commented that:

> "The whole federal process makes the issue distant from the public – I don't feel involved. A lot of the material that is being produced is very unreadable. The web sites are complicated, have tons of linkages, and the information is often conflicting."

He stated, in addition, that, "I don't get questions about the technical nature of the information. The average person has no involvement in the climate change issue. They have not looked at any of the information available."

Lack of Institutional Capacity

A further structural constraint identified in the EA data that could be applicable to local climate change initiatives was 'lack of institutional capacity', which refers to the lack of capability or infrastructure within community institutions to support public involvement in resource and environmental management processes. This category was developed to classify an idea expressed by a government official, who commented that in some remote communities "there is no real community around that wants to come to big meetings. In many cases, there will not be a pool of local people around to participate." This notion was also raised by the ENGO representatives interviewed, one of whom commented:

> "The ENGO community is pretty poor throughout the province – it really is. A lot of members have never responded or tried to find files, etc. They depend on others to do the legwork. There are certainly people on [boards of local ENGOs] who have never been really engaged in the process – they have just provided comments – they would not know where to look for things."

Lack of institutional capacity within civil society as a barrier to public involvement has received considerable attention in the EA literature and an important element of these discussions has been lack of resources. In their study of barriers to involvement in the Keephills thermal power plant EA, Frideres et al. (1992) observed that community-based publics lacked resources to create the knowledge they needed to challenge proponent and state positions. A number of authors have identified the need for participant funding to address this problem (e.g., Gibson 1993; Smith 1993; Wood 1995), and this view has been advocated by Canadian ENGOs for years (Canadian Environmental Network 1988; Praxis 1988).

Another dimension of institutional capacity that has been identified as a barrier to public involvement in EA is conflicting institutional arrangements. According to Frideres et al. (1992), the institutional settings for environmental assessments are products of an ideology favoring hierarchical, bureaucratic arrangements. These typically conflict with structures of the community publics involved in the process, which often operate within the framework of a collectivist ethos.

Factors related to institutional capacity have relevance to discussions of barriers to public involvement in local climate change initiatives. With respect to capacity in civil society, there is a distinct lack of local groups for whom climate change is a primary focus (Andrey and Hachey 1995), unlike in areas such as waste management, wilderness conservation, etc. In addition, data from the Green Commuting project support the contention that conflicting institutional arrangements could constrain public involvement. In trying to secure the involvement of large organizations, many of which reflect what cultural theorists call a hierarchist value orientation (O'Riordan and Jordan 1999), project staff found that:

> "We were surprised how bureaucratic some industrial sites were. It was clear that some – especially the larger ones were concerned about letting us into their workplace to talk to employees."
>
> "We run into the problem that lots of these companies are big corporations and have all the things that you would expect – nice offices, dress codes, up to date computers, and other machines, etc. They look at our office and us and say, if they knew what they were up to they would have more stuff."

While recognizing that "the exact amount of elasticity in the institutional structures that frame human agency is a matter of considerable debate" (O'Riordan and Jordan 1999, 82), another factor of institutional capacity that could encumber public involvement in local climate change initiatives is lack of flexibility in institutional settings. Many organizations, largely bureaucratic and hierarchical in nature, approached by the Green Commuting Project lacked sufficient flexibility to easily participate in the services being offered. For example, project staff reported that:

> "Finding the right person to talk to is another big problem. Often the first contact does not see themselves as the right person yet they have trouble referring. At [a large Manitoba corporation] I was dealing with the green procurement officer, then the fleet manager, and finally at a meeting I met a women named [R] from the economics side that was working on projects to reduce the corporation's contributions of greenhouse gases. She was interested and talked internally and they told her to run with it. Then [her responsibilities changed] and she had no time. She finally put me onto the environmental education specialist who I should have been referred to in the first place. He talked to some people but I could tell he was not into it from the start. He came back saying he and others had no time and that the nurse was worried about people riding to work…"

Lack of Understanding

Upon reviewing the EA data, 'lack of understanding' emerged as an important subcategory of individual constraints. The basic idea is that lack of knowledge deterred people from participating in the EA process. 'Technical issues' was a strong and recurring subtheme of lack of understanding and echoed the earlier contention that overly technical discourses hinder public involvement. 'Potential impacts' was also an important subtheme of lack of understanding. A key idea reflected here is that members of the public were not aware of the breadth and depth of potential impacts:

> "And, again, most people without any sort of training have no idea of the potential impacts of secondary, tertiary impacts of certain projects. To them, they're simply isolated events…"

This subcategory also captured the notion, discussed in the EA literature (Praxis 1988), that some people are not aware they will be impacted by a project:

> "Everyone who lives in the city is going to be affected one way or another, either financially, you know, tax base, or business opportunities, transportation. They are going to be affected but they may not realize it."

In respect of local climate change initiatives, lack of understanding is a formidable constraint on public involvement. The climate change literature indicates low levels of public awareness of both the causes and impacts of climate change. Moreover, the literature reinforces the suggestion that increased public awareness is a prerequisite for broad involvement in local initiatives aimed at behaviour change (Andrey and Hachey 1995; Herrington and Barrett 1996; Public Education and Outreach Issue Table 1998; 1999; Herrington et al. 2000). The data obtained on the Green Commuter Project are congruent with the literature on these issues:

> "The average person has no involvement in the climate change issue. They have not looked at any of the information available. They have only a vague idea from what they get in the newspapers that the government is doing something. So they have not looked at the information."

> "[Lack of understanding] is a problem. My best example is the guy that says climate change is about the CFC's that might leak from his fridge and does not see or realize the link to his car."

CONCLUSION

The foregoing discussion reviewed selected barriers to public involvement in EA, examined their relevance to local climate change initiatives, and revealed a high degree of applicability. A more comprehensive analysis would undoubtedly have disclosed a number of EA barriers that were not pertinent to climate change. After all, there are fundamental differences between environmental assessment processes and the implementation of community-based education and outreach initiatives. However, a more comprehensive review would also have revealed additional barriers that do fit the climate change discussion. Without going into detail, it is evident that 'not directly affected', an individual constraint, is directly relevant to public involvement in local climate change

TABLE 1. Constraints Derived From the Environmental Assessment Data

Primary Categories	Secondary Categories	Tertiary Categories
structural constraints	involuntary complexity	consumerism
		consultation fatigue
		competing social event
		competing volunteer activities
		work commitments
		family commitments
		social stresses
	process deficiencies	inadequate notice
		inaccessible information
		lack of participant funding
		poor logistics
		not encouraged, invited
		too bureaucratic
		lack of opportunities, avenues
		unresponsive to local concerns
		lack of credibility
		foregone conclusion
	alienating dominant discourses	censorship
		proponent control of public involvement
		role of media
		tough environmental laws
		technical focus
		extremism
		activism
		nay sayers
	lack of institutional capacity	
individual constraints	concerns were adequately addressed	
	not (directly) affected	
	left it to others	trust in government
	lack of skills	public speaking
		preparing written briefs
	lack of understanding	legal rights
		potential impacts
		EA process
		technical issues
		disciplinary focus
		role of the media
		education
	character traits	job constraints
		lazy
		apathetic
		indecisive
		shy
		lack of community ethic

initiatives. The central idea being that members of the public choose not to become involved when they think they are not directly affected by a proposed project. Similarly, 'left it to others' and the related 'trust in government', further individual constraints, appear to be germane to the climate change debate. These categories compiled comments reflecting the general idea that some people choose not to become involved because they believe others adequately represent their interests.

Given this concurrence, climate change policy makers and front line workers could learn from EA experiences when developing approaches to public involvement and responses to constraints on public involvement. For example, involving publics early in the process, at normative and strategic levels of planning (Smith 1982), could help address operational barriers such as foregone conclusion. Early involvement, which is dependent upon mutual learning among participating publics, could also help respond to cognitive barriers such as technical focus and lack of understanding. It could also help resolve tensions associated with the extremism factor if diverse and traditionally antagonistic stakeholders are involved equally at all levels of planning.

Consistent with, and in support of, involving publics early in the process, local climate change initiatives could benefit from adopting critical or transformative approaches to adult education and learning. There are small but growing literatures on applications of these ideas in resource and environmental management (e.g. Alexander 1999; Diduck 1999) that could be instructive in the climate change debate. Accepting the transformative possibilities of human agency, these approaches focus on empowerment of resource communities and active participation in the civic life of the community, and rather than relying on behaviouristic mechanisms such as social marketing and advertising, they rely on deliberative and dialogical methods. Such goals and methods fit nicely with public involvement in normative and operational levels of planning and could be valuable in overcoming barriers to involvement.

In addition to EA, there are other resource and environmental management areas that rely heavily on public involvement processes, such as integrated resource management, from which lessons can likely be extracted for use in climate change discussions. For that matter, lessons can without a doubt be drawn from other disciplines that have developed vast literatures on the theory and practice of public involvement or citizen engagement, such as planning and political science. In fact, broadening the scope of the inquiry to include such disciplines is likely essential to respond to what would appear to be intractable barriers such as involuntary complexity and lack of institutional elasticity. Such barriers, involving complex webs of structure and issues such as the 'paradox of constraint' (Grafstein 1992), would appear to require a transdisciplinary or, at the very least, an interdisciplinary response. ❑

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Learning to Engage: Experiences with Civic Engagement in Citizens

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Miriam Wyman

ABSTRACT

Canadians love to talk about the weather and we think there is nothing we can do about it. Addressing environmental problems effectively is one of the challenges of our age. While science searches - often with great success - for information about the extent of problems and possible solutions, the more difficult issues centre around human responses - how to communicate about the issues and how to successfully promote changes in entrenched patterns of behaviour.

Three things stand out in opinion polls taken in Canada over the past 15 years. One, people want changes in the way governments run many programs. Two, they want to be involved in making those changes. Three, they feel unable to make the changes they want. The desire for change, the thirst to be involved, the feelings of alienation and frustration - these contribute to citizens' declining trust in their governing institutions and to their feeling that much of the consultation that does occur is lacking in legitimacy.

Citizen engagement is a process of interaction between decision-making bodies (often governments) and citizens affected by those decisions. It is about giving citizens a voice on issues that matter to them and that will have an impact on their lives. It is a way to broaden democratic participation on issues of public policy.

This presentation will focus on two current citizen engagement exercises:

- The Society We Want *is a national public dialogue project of Canadian Policy Research Networks (CPRN). It brings people together in small groups, with an experienced moderator, to reflect on key issues in a way that allows citizens to express their concerns, to raise questions, and to provide informed responses. It is proving to be a useful way of engaging citizens on issues that affect their lives and their communities and of providing rich and thoughtful information to decision-makers and policy makers about what matters to people in Canada. It is one of the hallmarks of the newly established Centre for Public Dialogue, a centre of expertise in deliberative dialogue which responds directly to citizens' desire for input to decisions which affect their lives.*
- Civil Society in the New Millennium *is a project of the Commonwealth Foundation that engaged citizens around the world in reflecting on three questions:*

- *What is your view of a "good" society?*
- *What is roles are best played by citizens and what roles are best played by the State and other sectors in such a good society?*
- *What would enable citizens to play their role in the development of society more effectively in the future?*

These processes illuminate awareness building, barriers to involvement and strategies for promoting public involvement. This session will review these processes and work with participants to clarify how engaging citizens can assist in communicating about climate change. ❑

Assessing Adaptive Capacity in the Coastal Zone: A Case Study of the St. Croix Estuary Project

Dean Searle

Adaptation is an important component of Canada's climate change response agenda. Integrated coastal zone management (ICZM) has been identified as one means to improve adaptation in coastal areas. This research assesses the adaptive capacity of the St. Croix Estuary Project (SCEP) in the context of anticipatory adaptation. SCEP was compared to an evaluative framework for improved adaptive capacity which concluded that SCEP appears well suited to meet the needs of adaptation. While SCEP demonstrates the means necessary to adapt, adaptation is not currently part of its management agenda. Possible reasons and alternatives are discussed.

INTRODUCTION

Adaptation is a vital component of the climate change response agenda. Canada has committed to reducing its vulnerability to climate change but we are still defining adaptation as part of a national framework. In addition, Chiotti (1998) reminds us that Canada's regional differences will require more targeted policies. Further research is required to understand how communities, institutions and organizations contribute to the adaptation process at the sub-national level, particularly in regions and sectors vulnerable to the of effects climate change (Chiotti 1998).

Abraham et al. (1998) demonstrate the potential vulnerability of Atlantic Canada to climate change. Atlantic Canada has an extended coastal environment that is very important to the region's culture and economy. Shaw et al. (1998) identify large portions of the Atlantic Canadian coast as highly sensitive to climate change. The Atlantic Coastal Action Program (ACAP) was initiated in 1991 to help coastal communities improve the quality of their environment and work towards improved sustainability. While ACAP has demonstrated some success (Ellsworth et al. 1997; Robinson 1997), its potential as a vehicle for climate change adaptation is unknown. It is assumed that efforts to improve the effectiveness of integrated coastal zone management will also improve the capacity for adaptation.

This paper attempts to understand the potential of ACAP as an adaptation mechanism. The paper presents a case study of an ACAP site which is later compared to an evaluative framework for adaptive capacity. The paper begins with a brief background of the research context followed by the adaptive capacity framework and a description of its criteria. A case study of the St. Croix Estuary Project is then presented and assessed according to the framework. The paper concludes with a discussion of the findings.

Background

Societies have developed a number of devices, arrangements and mechanisms that allow them to adapt to environmental change and climatic variability (Burton 1996). Tol (1996) uses the term 'coping mechanisms' to describe all actions specifically taken to reduce the damage from environmental change and climatic impacts. The challenge is how to strengthen existing mechanisms to manage the extra demands of climate change (Downing et al. 1996).

One mechanism that has received much attention is integrated coastal zone management (ICZM). Coastal areas are already sensitive to current climatic variability and are expected to be particularly vulnerable to the effects of climate change (Watson et al. 1998; CZMS 1992). ICZM is recognized as an appropriate process for addressing long-term climate change concerns within the context of current environmental pressures (Bijlsma 1997; Ehler et al. 1997; Huang 1997; Vellinga and Klein 1993; CZMS 1992). However, Rijsberman (1996) reports that ICZM and the IPCC Common Methodology are perceived as exclusive and top-down approaches that should be supplemented with bottom-up and participatory mechanisms.

The Atlantic Coastal Action program (ACAP) is a community-based ecosystem management initiative that is being applied as a form of ICZM in Atlantic Canada. ACAP began in 1991 under Canada's Green Plan as an attempt to incorporate ecosystem principles into coastal zone management (Noreena 1994). With the aid of Environment Canada, ACAP initiatives were founded in thirteen communities across Atlantic Canada (MAP 1). The initiatives were given seed funding for five years to develop a comprehensive environmental management plan (CEMP) to address important coastal management issues. In addition to building ecosystem management capacity, the initiatives used community-based techniques to build local leadership capabilities. ACAP has thus far been successful at demonstrating an effective form of alternative governance and shared responsibilities in coastal zone management (Ellsworth et al. 1997).

While ACAP has demonstrated the capability to manage traditional coastal management issues, its capacity to deal with the challenges of climate change is still unknown. Investigating current ICZM initiatives like ACAP should reveal important information about the possible effectiveness and limitations of using existing ICZM programs as an adaptation mechanism. However, there are currently no accepted means for understanding the capacity of such mechanisms as part of the adaptation process. The following section describes the concept of adaptive capacity and how it can be used to understand the management potential for climate change adaptation.

ADAPTIVE CAPACITY

Adaptive capacity is a recurring theme in adaptation research. Adaptation and impact assessment literature loosely describes adaptive capacity as a nation's ability to reduce its vulnerability to climate impacts through adaptation (Rothman et al. 1998: 5). Varied usage of the term obscures its meaning in research and its purpose in practice. For example, adaptive capacity has been used to describe both the ecological robustness of natural systems as well as the ability of decision makers to implement climate change adaptation strategies. The confusion surrounding adaptive capacity may arise from this loose terminology. Calls for increased adaptive capacity usually fail to clarify what they mean by adaptive capacity. Adaptation research should make explicit reference to the type of capacity they are referring to. This section will attempt to provide a more concise definition of the concept.

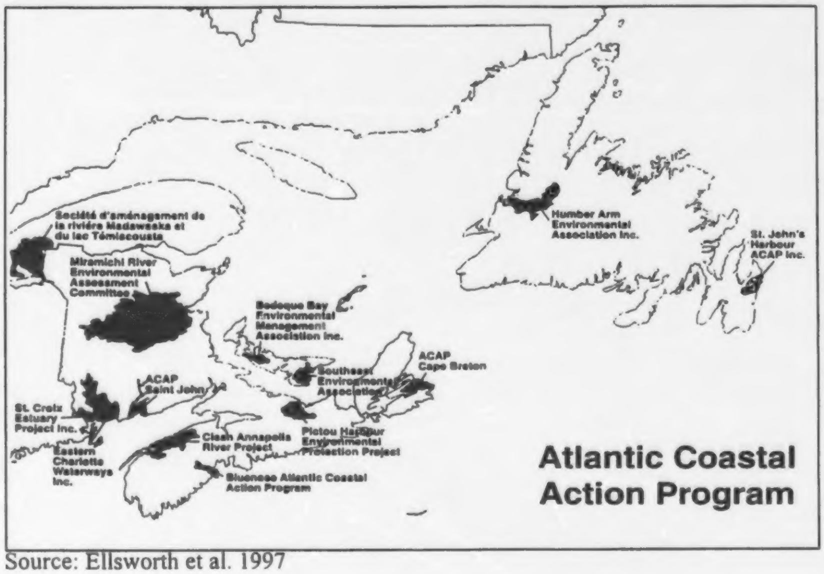
The semantics of 'adaptation' and 'capacity' reveal important distinctions that can translate into different operational meanings in practice. 'Adaptive' is usually used as an adjective referring to something that relates to adaptation (e.g., adaptive measures, adaptive strategies, adaptive capacity). However, 'adaptive' actually means being capable of adaptation. Honadle (1981: 577) defines 'capacity' as a measure of potential – to be potentially effective in an environment. Capacity is characteristically defined as either an ability (e.g., the capacity to…) or as a measure (e.g., the capacity of…). Similarly, capacity building is usually referred to by of the ways in which capacity is increased (means) or the product of those actions (ends).

Definition

This research defines adaptive capacity in the functional sense as 'the ability of coping mechanisms to manage the adaptation process.' This ability refers to the all tools, strategies, arrangements, and approaches used to increase the effectiveness of coping mechanisms. Managing the adaptation process refers to the ability to successfully:

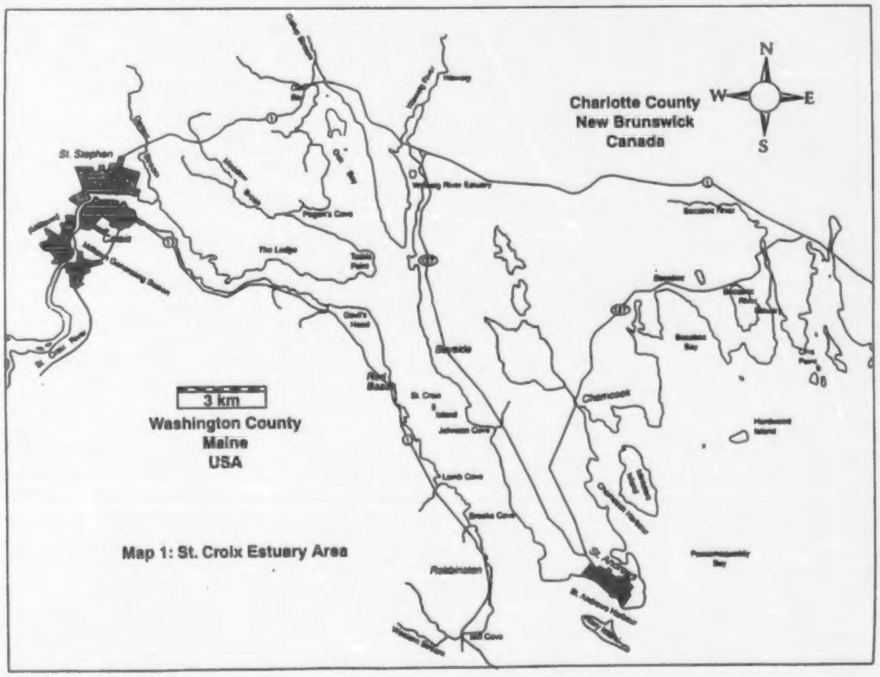
- anticipate and influence change (i.e., climate change impacts);
- make informed, intelligent decisions about policy (i.e., adaptation options);
- develop programs to implement policy (i.e., adaptation strategies);

MAP 1. Location of ACAP Initiatives


Société d'aménagement de la rivière Madawaska et du lac Témiscouata
Miramichi River Environmental Assessment Committee
Bedeque Bay Environmental Management Association Inc.
Humber Arm Environmental Association Inc.
St. John's Harbour ACAP Inc.
ACAP Cape Breton
Southeast Environmental Association
ACAP Saint John
St. Croix Estuary Project Inc.
Eastern Charlotte Waterways Inc.
Clean Annapolis River Project
Pictou Harbour Environmental Protection Project
Bluenose Atlantic Coastal Action Program
Atlantic Coastal Action Program

Source: Ellsworth et al. 1997

MAP 2. St. Croix Estuary Area


Charlotte County
New Brunswick
Canada
N
W
E
S
St. Stephen
Calais
The Lodge
Bayside
Red Beach
Chamcook
St. Andrews
Robbinston
3 km
Washington County
Maine
USA
Map 1: St. Croix Estuary Area

Source: SCEP 1997b

- attract and absorb resources;
- manage resources; and
- evaluate current activities to guide future action (Adapted from Honadle 1981).

Adaptive Capacity Framework

An evaluative framework for adaptive capacity is necessary for several reasons. The growing petition for increased adaptive capacity requires an improved understanding of what adaptive capacity is and how it can be developed. Adaptive capacity remains a large question in the discussion of climate change impacts (Burton et al. 1998) and the implementation of adaptation assessment recommendations (MacIver 1998). Finally, a framework may help decision makers move from normative and strategic planning towards a more operational agenda of implementing strategies to increase adaptive capacity.

The framework was developed through an extensive review of the literature. There are a number of recommendations on how to improve the efficacy of the adaptation process and reduce its barriers. However, this information is fragmented and scattered throughout the literature. This framework attempts to synthesize the methods, mechanisms, and strategies that have been identified to improve the process of managing anticipatory adaptation. The framework was developed through an analysis of global environmental change and hazards research that included academic and scientific assessments, government reports, workshops, and case studies.

The method of analysis involved reviewing the literature for normative statements and recommendations about the adaptation process, categorizing that information by subject, and then grouping the related themes into major themes. The review revealed a number of related subjects that could be grouped under six general themes (Table 1). The emergent themes may be distinct but they are not mutually exclusive, nor are they exclusive to the adaptation process. Elements of the themes can be found in other areas of environmental management so it is not surprising to find some synergy between themes. The components of the framework criteria and their key points are discussed below.

Collaborative

Adaptation research has recognized the importance of meaningfully involving those affected by adaptation measures and policies. A collaborative approach can encourage social learning and improve the communication of adaptation and impact assessments.

Stakeholders should be involved early and throughout all levels of the adaptation process.

Collaboration should use an inclusive rather than exclusive or expert-only approach.

Bottom-up participatory mechanisms should be used to encourage meaningful involvement rather than superficial involvement or tokenism.

Contextual

Adaptation should be placed in a context which reflects an appropriate 'functional' scale where the important

TABLE 1. Evaluative Framework for Adaptive Capacity

Collaborative	Dynamic	Preventive
• stakeholder involvement • inclusive • bottom-up	• adaptive and flexible • long-term outlook • ongoing process	• precautionary • no regret / win-win • independent benefits
Contextual	**Ecological Approach**	**Integrative**
• time and place specific (localized) • socially defined goals	• ecological boundaries • systems approach	• part of larger process • symbiotic

impacts and variables are relevant, identifiable, and manageable. Adaptation should also address existing pressures that may be amplified as a result of climate change.

Climate change impacts will be time- and place-specific and adaptation must be tailored to meet these localized needs.

The objectives of adaptation must be socially defined and acceptable to the impacted stakeholders and decision makers.

Dynamic

Adaptation is an ongoing process of change and adjustment to continually changing environmental and socio-economic conditions. Adjustments to the process may be necessary over time.

- Adaptation coping mechanisms must be flexible and able to adjust to ever-changing circumstances.
- Adaptation should be guided by a permanent or ongoing decision-making body and avoid being implemented in an ad hoc fashion.
- A long-term approach to adaptation is essential for defining short-term objectives.

Integrative

How a society perceives climate change in relation to existing issues is very important. Adaptation policies that complement larger socio-economic policies and initiatives should be more effective and have greater purpose.

- Adaptation efforts should be placed within the context of broader social goals (e.g., sustainable development, UNFCCC).
- Adaptation should be undertaken in coordination with existing environmental management initiatives.

Ecological Approach

Climate change impacts will be transient and crosscut across many social and natural boundaries. An ecological approach would help place the adaptation process within an appropriate spatial context.

- Defining goals according to ecological units rather narrow political boundaries should help determine appropriate adaptation objectives and actions.
- Adaptation mechanisms would benefit from an interdisciplinary systems approach that attempts to understand the multiple and interacting components of the impacted system.

Preventive

The United Nations Framework Convention on Climate Change (UNFCCC) Article 3.3 urges parties to take "…precautionary measures to anticipate, prevent or minimize the causes of climate change and mitigate [adapt to, reduce , abate] its adverse effects." Adaptation should be justified under any climate scenario.

- Adaptation mechanisms should incorporate a precautionary approach that centres around the need for caution and foresight, regardless of scientific certainty.
- Exploiting 'no-regret' or 'win-win' actions that reduce the impact of today's climatic extremes should also increase the capacity to adjust to future changes.
- Adaptation efforts should encourage strategies that result in benefits independent of climate change outcomes.

A CASE STUDY: THE ST. CROIX ESTUARY PROJECT (SCEP)

Data for the case study was primarily gathered through a group interview with members of SCEP's executive committee and document analysis of SCEP materials. The interview was conducted on location at SCEP's office in St. Andrews, New Brunswick and included SCEP's executive director, treasurer, and its full-time coordinator. Materials used for the case study include SCEP's planning documents, organizational documents (e.g., bylaws), annual reports and outreach materials.

Background

The St. Croix Estuary is nestled in the Passamaquoddy Bay area between the New Brunswick-Maine border and is part of the larger Bay of Fundy and Gulf of Maine coastal systems (Map 2). The Estuary area includes the estuarine and marine waters as well as the adjacent lands in Charlotte County, New Brunswick and Washington County, Maine. The St. Croix River watershed is the largest contributor of freshwater into Passamaquoddy Bay and the second biggest freshwater contributor into the Bay of Fundy (SCEP 1997). The St. Croix Estuary is noted for its rich ecological environment and aquatic resources that are especially important to the local fishing and tourism industries.

The St. Croix Estuary Project (SCEP) is a community-based ecosystem management initiative that incorporates bottom-up mechanisms with ecosystem management concepts. The organization's mandate is the environmental protection and improved sustainability of the estuary area. SCEP's office is located in St. Andrews, New Brunswick (pop. 1650) but its management area extends along the entire estuary area including ten other communities and un-incorporated areas on both sides of the border. SCEP also encourages participation from local industries and their representatives. It is from these diverse areas that SCEP draws the board members and volunteers that are the heart and soul of the organization.

SCEP is a not-for-profit, non-governmental organization incorporated under the New Brunswick Legislature. SCEP is governed by an eighteen-member board of directors (BOD), with a five member executive committee chosen from the BOD. In addition, at least two but not more than five members should be residents of Maine. Board members are voted in for two year periods staggered every other year (i.e., one half of the board are voted in each year) and are sought from the following sectors:

- economic and community development
- primary utilization of natural resources
- business directly relating to the St. Croix estuary (e.g., marine transportation)
- recreation directly relating to the St. Croix estuary (e.g., boating)
- environmental protection and conservation
- science and education

SCEP also employs a paid full-time coordinator to oversee the everyday activities of the organization. The coordinator also acts a 'window' or liaison between the board and Environment Canada.

Management Process

One of SCEP's main contributions was the development of *Caring for Our Coast* (SCEP 1997), a comprehensive management plan (CEMP) for the St. Croix Estuary. The CEMP was developed over a five year period which included an initial assessment of key local issues (1991-1992), a visioning process to determine the vision and values of local residents for the Estuary (1993-1994), and development of environmental monitoring activities (1993-1995). In all, approximately 200 people and 250 technical and other documents have contributed to the CEMP planning process (SCEP 1997). The CEMP complements many other local and regional efforts and plans towards coastal management including the *St. Croix International Waterway Management Plan* (1993), the New Brunswick Commission on Land Use and Rural Environment (CLURE) (1993), and the Fundy Marine Ecosystem Science Project (1995-present).

The CEMP addresses over thirty issues and recommends fifty actions towards the improvement of environmental management and sustainability of the estuary. Table 2 lists the CEMP's eight major issues and the number of actions associated with the issue. Actions are also ranked by their priority for action (urgent, necessary, and desirable). While some actions are exclusive to particular issues, many are complimentary and overlap in more than one category. The objectives of the actions are intended to be realistic, achievable and measurable (SCEP 1997).

The actions described in the CEMP are intended to improve the quality of the Estuary's environment and help SCEP build the organizational capacity necessary to achieve its goals. SCEP recognizes that all of the identified

TABLE 2. Action Plans for Key Issues

Management Issue	Total Actions	# Urgent	# Necessary	# Desirable
• wastewater discharge	13	(1)	(8)	(4)
• land use and development	8	(1)	(5)	(2)
• marine shipping	4	(2)	(1)	(1)
• aquaculture	6	(1)	(2)	(3)
• fishing (commercial and recreational)	18	(2)	(14)	(2)
• rockweed harvesting	4	(1)	(3)	(0)
• tourism and recreation	17	(2)	(11)	(4)
• ecological/environmental research and monitoring	6	(0)	(1)	(5)

Source: SCEP 1997a

TABLE 3. Key Stakeholders and Partnerships

- St. Croix International Waterway Commission
- Federal agencies (including limited participation by US federal agencies)
- International Joint Commission Pollution Control Advisory Board: St. Croix
- Provincial and State agencies
- municipal governments and local service districts
- Passamaquoddy Tribe (First Nations)
- industry (fishing, aquaculture, pulp, tourism)
- research and education organizations
- local public and landowners

Source: SCEP 1997a

actions cannot be realized alone. In these cases, SCEP acts in conjunction with its many partners to implement the plans (Table 3). SCEP identifies approximately twenty-five to thirty organizations in New Brunswick and Maine it considers as key stakeholders (SCEP 1997). These partnerships can supply the necessary information, technical, support, and evaluative resources. Thus, SCEP is neither truly bottom-up or top-down but instead maintains an appropriate management equilibrium.

Evaluating Progress

The CEMP was published in March 1997 and SCEP has since addressed over thirty of the actions, either in whole or in part (SCEP 1998). SCEP continues to address its plans while gathering feedback from its stakeholders and partners about its future needs. The CEMP was developed as an open or 'living' document rather than a narrow blueprint of tasks. New issues are continually being addressed and old issues redefined as SCEP continues to promote environmental protection and education in the estuary area.

COMPARISON OF SCEP TO ADAPTIVE CAPACITY FRAMEWORK

SCEP has a number of characteristics that would improve the anticipatory adaptation process. When compared to the framework, SCEP conforms well to the adaptation needs identified in the literature. Table 4 summarizes the key points of the comparison by demonstrating where SCEP conforms or diverges from the framework. Each of the component criteria are rated according to a qualitative measure of 'low', 'good ' or 'high'. A low rating means SCEP needs much improvement in this area; a good rating means SCEP does well in the area but there is still room for improvement; and a high rating indicates that SCEP has progressed well beyond the basic needs for effective adaptation in this area.

Assessment

SCEP's community-based approach is well suited for managing the collaborative and contextual needs of the adaptation process. SCEP's approach towards community-based management is charactersized by locally-driven processes and collaborative mechanisms that demonstrates a high degree of potential for increasing adaptive capacity. SCEP's multi-stakeholder, consensus building approach could also facilitate social learning, a means to overcome barriers in public acceptance and understanding of adaptation policies.

SCEP incorporates a number of other environmental management approaches and mechanisms that would benefit adaptation efforts. The purpose of ACAP was to implement ecosystem management concepts within a

TABLE 4. - Summary of SCEP Comparison to Adaptive Capacity Framework

- Collaborative - Assessment: HIGH CAPACITY
  - SCEP's community-based approach uses bottom-up participatory mechanisms to encourage public involvement and consensus building
  - SCEP uses multi-stakeholder approach that has partnerships with many levels of government, organizations, industries, and public interests
  - alternative forums of public involvement was used in planning process and continues to be used in the realization and evaluation of SCEP's action plans
- Contextual -Assessment: HIGH CAPACITY
  - SCEP is focused on realistic, achievable and measurable objectives at the local level
  - community-based ecosystem management helps define appropriate scales of action
  - the CEMP scoping and visioning process ensured SCEP's objectives were consistent with local needs and existing concerns
- Dynamic - Assessment: GOOD CAPACITY
  - the CEMP is an open document that can be updated and modified with changing needs
  - the visioning process helped define short-term objectives within long-term outlook
  - SCEP is an incorporated, not-for-profit NGO that continues to work towards improved environmental management and sustainability in the estuary area
- Ecological Approach - Assessment: GOOD CAPACITY
  - SCEP's management boundaries are defined by the properties of the St. Croix Estuary
  - SCEP addresses transboundary issues that affect two nations and multiple ecological systems
  - SCEP is currently gathering ecological data to improve its understanding of the Estuary system
- Integrative: Assessment: GOOD CAPACITY
  - SCEP is part of ACAP and was initiated as part of Canada's Green Plan
  - SCEP was developed as part of ACAP's ICZM agenda
  - the CEMP is complementary to many other plans and activities in the area
- Preventive - Assessment: LOW CAPACITY
  - no formal integration of a precautionary approach
  - SCEP is not currently addressing any climate impact issues
  - ecosystem restoration and management activities can contribute to increasing the resilience of the estuary to climate impacts

community management framework. The definition of SCEP's management area illustrates a successful integration of ecosystem principles. The incorporation of a systems approach requires an understanding of the linkages between systems and an acceptance that system changes are difficult to predict. The development of an open CEMP that can adjust to changes while still working towards long-term goals demonstrates foresight. In addition, being part of a larger initiative like ACAP gives SCEP the advantage of a supporting network that can share resources and work towards common goals.

Although the framework's basic criteria for dynamic, integrative, and ecologically oriented mechanisms have been met, there is still room for improvement. SCEP appears well prepared to manage the physical effects of climate impacts, but it is uncertain how prepared the organization is to meet the organizational challenges of climate change. Climate impacts may manifest in surprising forms in coastal areas. SCEP must be able to move beyond its reactive approach of the immediate and tangible towards a more proactive approach.

The notion of a proactive approach leads into the needs of the preventive criteria. This component of the adaptive capacity framework is perhaps more exclusive to the area of climate change adaptation than the others. Because SCEP has yet to define its climate change response agenda, it lacks the precautionary and 'no-regret' outlook required to reduce climate impacts. SCEP also appears more concerned with solutions to man-made problems rather than systemic issues such as coastal erosion or storm damage. However, SCEP's efforts to improve the ecological integrity of the estuary can increase the resilience of the estuary to climatic perturbations.

DISCUSSION

Improving coastal management has been identified as an appropriate vehicle for improved climate change adaptation (Bijlsma 1997). When compared to the adaptive capacity framework, SCEP's potential to effectively implement adaptation efforts appears to be quite good. However, SCEP's true adaptive capacity remains unknown because it has yet to address any climate change or climate variability issues.

Perhaps one reason why SCEP has yet to develop a response agenda is because climate change is not a tangible concern like pollution or water quality. Because climate change is not as immediate as other problems, it may be difficult for stakeholders to commit resources to adaptation efforts when existing problems have yet to be solved. Stakeholders perceptions may also be subject to the conflicting arguments for and against climate change adaptation. One issue that emerged from the case study is that SCEP members are still sceptical about the effects of climate change and have adopted a 'wait and see' attitude.

Better communication efforts to promote education and awareness of climate change issues may be necessary for SCEP to become more involved in the anticipatory adaptation process. Part of ACAP's funding requirements during the CEMP development phase was that the initiatives had to address several key coastal and watershed issues as part of the CEMP. These issues were the minimum requirements and initiatives were given free reign to cover as many issues as they felt necessary. As part of ACAP's commitment towards improved ICZM, it may be necessary for ACAP or Environment Canada to augment its role to encourage the development of response agendas.

This proposal may be considered contradictory to the spirit of community-based management. However, improving the dissemination and communication of climate change information to a target audience, for a specific purpose like improved coastal zone management, might provide initiatives with the information they require to make informed decisions. In addition, most adaptation methodologies are technically oriented and are intended for an expert audience. Environment Canada may be able to process the technical information into a digestible format so initiatives can incorporate that information into their own impact and adaptation assessments.

CONCLUSION

The ability of SCEP to reduce its vulnerability to climate change impacts appears to be quite good. SCEP has the mechanisms necessary for reducing barriers to the adaptation process and promoting consensus and support.

Unfortunately, SCEP is not currently addressing its climate change concerns so it is difficult to provide an empirical judgement of its progress. SCEP's coastal management efforts are improving the estuary environment and building a strong natural capacity for adaptation. However, it may be necessary for SCEP (or ACAP) to introduce an explicit adaptation agenda into the larger ICZM process in order to build the necessary organizational capacity to manage climate change. Future research may reveal how representative these findings are in comparison to other community-based management initiatives in other critical regions and sectors. ❑

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Session C4

CIVIC ENGAGEMENT 3: SOCIAL MARKETING STRATEGIES

Walking the Talk in Ottawa Through Community-Based Social Marketing
Dana Silk
EnviroCentre

The Change Starts Here - A Climate Change Employee Awareness Pilot Project
Brad Wallace
Innovative Management Solutions Inc.

Lessons Learned from the Blue Box Recycling Program
Hélène St. Jacques
Informa Market Research

Taking Residential Energy Efficiency to the Streets: What Gets the Public Involved?
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Walking the Talk in Ottawa Through Community-Based Social Marketing

Dana Silk

Community-based social marketers maintain that people are more likely to do socially desirable things, like recycling, when they have been encouraged to do so through personal contact at the community level. EnviroCentre is testing whether or not such techniques can help households make bigger changes, like adopting more energy-efficient transportation habits. Various groups of people were provided in different ways with packages promoting and prompting such changes over a two-week period in May and June when walking, biking, and waiting for buses is easier to do in Ottawa. Through the use of control groups, diaries, and follow-up surveys, changes in their attitudes and behaviour are being monitored.

INTRODUCTION

In October 1999, EnviroCentre signed a research contract with the federal Climate Change Action Fund and the Region of Ottawa-Carleton to work with the local transit company, OC Transpo, to test the potential of community-based social marketing (CBSM) to change transportation habits.

Up to 600 households, who had already been involved in or were paying for a Green Home Visit, an EnerGuide for Houses evaluation, or a water conservation service, were provided with packages promoting new transportation options. Some packages were simply mailed out, but most were delivered in person after some level of commitment was solicited from the householder to become involved. Some packages also contained a free, one-day bus pass and an attractive "prompt" to remind them of their commitment to participate in the project over a two-week period in the months of May and June. Through the use of control groups, diaries, and follow-up surveys, reported changes in their behaviour were monitored. The small sample sizes were not meant to generate detailed data but to show whether or not a community-based organization that is already in homes providing advisory services can use low-cost, CBSM techniques to effect changes in at least the attitudes, if not the transportation habits, of its clients.

By combining social marketing science with community-based credibility and capacity, and by building partnerships with other stakeholders, EnviroCentre proposed to show, through carefully monitored field work, how CBSM could help people overcome barriers to behavioural change in the field of transportation demand management (TDM). Complementary research and monitoring included an analysis of TDM attitudes and behaviour among another 600 households in the Region that received a free Green Home Visit in 1994 and 1995.

MASS MARKETING, SOCIAL MARKETING, OR NICHE MARKETING?

Mass marketing in the transportation sector continues to work very well for those industries that can afford it, but billion dollar advertising campaigns are simply not in the books or budgets of most governments, and certainly not local governments. Social marketing has been used successfully for some things, like ParticipAction, when people need just a little reminder to exercise, but it has not worked well when the perceived benefit is too far away in time or space and is not linked to a "sense of community".

Although there is considerable experience in energy conservation dating back for almost 25 years in Canada, little research has been conducted on the impact of social marketing, and even less is available on the effectiveness of CBSM. There have also been considerable demographic and lifestyle changes since the 1973 oil embargo that will affect what will and will not work today. The roles of utilities, all government levels, and the private sector have also changed considerably, notably over the last few years in Ontario. New marketing techniques and partnerships need to be researched and developed in such a way that they can be adapted to changing institutional and market circumstances.

Researchers in the United States have learned that 'environment' is a secondary rather than a primary motivator: it will not prompt consumers to action but many feel it would be an extra "feel good, win-win" benefit (Alliance to Save Energy 1998). It makes little sense to design a campaign to get people to insulate their homes to protect the environment if most people ready to invest in energy conservation are motivated by saving money or more comfortable homes.

Some of the lessons learned over the years still apply today, including the fact that people place much higher value on things that they pay for, as opposed to free advice. Can we conclude, however, that people who had free Green Home Visits were less likely to implement the recommendations than those people who paid $150 for more professional advice, or that CBSM, done in a professional way, can indeed result in "three to four times as many people" electing to retrofit their homes or take other similar action? (McKenzie-Mohr 1996), let alone leave their cars at home?

In the absence of more definite research on who is ready to 'move on sustainable transportation', it appears that we are presently dealing with a 'niche market' whose characteristics need to be identified. We need to develop more efficient techniques to identify and reach those people who are currently prepared to respond favourably to CBSM and other incentives to engage in TDM programmes. They should provide sufficient 'sales' and/or uptake rates in the short-term and, more importantly, provide a community base for increasing penetration rates in the long-term.

By working primarily with people who have already indicated some interest in improving the energy-efficiency of their home, we should be able to get them to do something that ***they really want to do*** (e.g. improve the comfort of their home and save on heating costs) while exploring how to engage them in activities that ***they like doing*** but rarely do (e.g. walk and bicycle) as well as activities that ***they don't mind doing*** but rarely think about (e.g. get a ride with someone else). The successful techniques could then be refined for the much more difficult task of getting people to do something ***that many would rather not do*** (e.g. take the bus).

This suggests a marketing strategy that balances our need to generate 'sales' today while educating the marketplace so that future participation rates will increase. Can we afford to waste limited resources appealing to a mass market that is not yet ready to become involved or should we concentrate first on those people - conservation pioneers - that are ready, or almost ready, and use the right prompts at the right time and place to get the behavioural change or 'sales' we are seeking?

Are there any research results on what TDM measures such conservation pioneers have taken and what could prompt them to improve their driving habits, get regular tune-ups, or buy cleaner fuels? Could such research help increase the synergistic effects of government programmes, like EnerGuide for Houses, if it were to show that only a few modest prompts could also get them to buy more energy-efficient vehicles and appliances? As a local transportation planner concluded, "the principal need at the moment is for governments, non-profit organizations, academics and community-groups to experiment with community-based social marketing, evaluate different approaches, and communicate the results" (Noxon, 1997).

Conservation pioneers could reveal a wealth of information on the factors that motivated them to seek advice on energy conservation measures, on what they did as a result, and on what it might take for them to make additional changes, including taking the bus, joining a car pool, or engaging in more active transportation modes or more responsible vehicle use. They could be an invaluable source of information on the barriers to implementing energy conservation programs and also prime candidates to engage in CBSM because of the importance of investing scarce resources in people that are pre-disposed to act rather than wasting time and money on those not yet receptive to change.

COMMUNITY BASED SOCIAL MARKETING

CBSM has been shown to be more effective than both mass marketing and social marketing (certainly per dollar invested) because it "actually provides consumers with the means - either psychological or material - to overcome barriers in initiating and sustaining behavioural change". Research in the United States has shown the difference between promoting recycling by making use of community volunteers, and by simply distributing flyers: "28% of the homes visited by block leaders recycled weekly, compared to only 12% for those who just received a flyer; furthermore, over 58% of those homes visited by block leaders continued to recycle, compared to only 38% of those homes that just received the flyer" (McKenzie-Mohr 1996).

Research sponsored by the Climate Change Secretariat (1998) has also shown that: "Attempts to change specific behaviours were most effective when there was direct contact with the individual and when changing the behaviour was made as easy as possible, including on-site demonstrations and provision of materials".

Such research has shown promising results with CBSM when it comes to socially desirable activities that require little change in behaviour and for which barriers can be easily identified and reduced, if not eliminated. Less research has been done, however, to determine if CBSM can generate significant results for socially desirable activities that require bigger changes in behaviour to overcome bigger barriers, such as those involved in a shift to using public or other forms of transportation that reduce the use of single-occupant cars.

Although community based organizations have been making substantial contributions to society for many years, their use of social marketing has only recently been recognized for its low-cost ability to change attitudes towards all sorts of issues, including drinking and driving, smoking, exercise and fitness, and recycling. It draws heavily on research in social psychology which indicates that initiatives to promote behavioural change are often most effective when they are carried out at the community level and involve direct contact with people (McKenzie-Mohr 1999).

It helps when that communication is made through someone, in a position of trust, who is able to extract some level of commitment (oral, written, or even public) from the participants to take specific actions. In Iowa City, people who committed to having their names published reduced their usage by 10-20%, whereas there was no significant reduction when participants were assured of anonymity. Such techniques will help ensure that the changes in behaviour are sustained well into the future. Motivated people also tend to spread the word to family, friends, and neighbours (Kassirer and McKenzie-Mohr 1997).

Prompts are an important component of the CBSM toolkit because they remind people about their commitment to do something as opposed to simply exhorting them to do something. It helps if the prompt is attractive and or novel and relates specifically, in time and space, to the task and audience involved. Slogans and non-specific reminders "generally have very little effect on actual behaviour" (Gardner and Stern 1996).

CBSM campaigns depend heavily on information and education. People must recognize an issue as a problem that needs solving, understand how they are directly connected to the problem, and how a change in their behaviour can affect them and their family in a positive way. But many forms of information and education programs may not work with CBSM. A flyer dropped in a mailbox with tips on how to save energy at home may be given as much attention as a flyer promoting the local pizza place. It will most likely go straight into the trash or, with a little luck, the recycling bin. The margins on pizzas might warrant such forms of advertising, but it is hard to justify spending public funds or the limited budgets of non-profit organizations on campaigns that have such slim returns.

If, however, such flyers are distributed by someone who has been invited into a home to perform either a free service or, better yet, to provide a professional service, the chances of the flyer being read are already much higher. The chances of people paying more attention to the contents, and believing them, are even higher if the person is representing a non-profit, community-based organization. Research in the United States has confirmed that there is a strong anti-government sentiment when it comes to energy conservation programmes (Alliance to Save Energy 1998), and that "evaluations of home insulation program typically conclude that working with local groups, churches, neighbourhood associations, etc. is the best way to promote a program (Stern et al. 1986). Analyses closer to home have also concluded that: "volunteers in NGOs garnered 87% in confidence levels, while politicians received 13% and public servants 30%" (Public Policy Forum 1998).

Barriers to achieving the desired behaviour change need to be identified at the beginning of any CBSM campaign so that tools and prompts can be designed to overcome them. The City of Boulder, Colorado, for example, wanted to increase transit ridership but employees expressed concern that if they had to work late, their normal bus might not be available. So in addition to providing employees with free transit passes, some local businesses also guaranteed a free taxi ride home if employees had to work late or in an emergency. Knowing how to overcome one of the main barriers before implementing this program helped create a 6% modal shift from single-occupant vehicles (Kassirer and McKenzie-Mohr 1997).

Similarly, identifying what motivates people to particular actions will help encourage participants to continue the actions they've already taken, and can encourage them to a greater commitment in the future. If a householder expresses interest in gardening, advisors could stress garden-related recommendations (e.g. planting shade trees). If there are children in the home, health issues might be stressed (e.g. inadequate ventilation leading to moulds). Some of the latest research in this field shows that: "When residential energy auditors ... were taught to use the behaviour change tools, they influenced three to four times as many householders to make their homes more energy efficient" (McKenzie-Mohr and Smith 1999).

WALKING THE TALK?

A Steering Committee helped set the stage for this project by showing what each stakeholder was most interested in: the Region wanted to experiment with practical examples of CBSM to get cars off the roads; the City of Ottawa wanted to meet its CO2 emissions reduction goals; OC Transpo wanted to increase ridership; and EnviroCentre wanted to generate measurable results that could be applied to residential energy conservation programmes.

Given the research nature of the project, it was agreed to drop any non-TDM prompting so as not to jeopardize the results, and to enlist the services of the Survey Centre at Carleton University's School of Journalism to ensure that the survey generates reliable results. As there was little interest in data based on gender, sex, income, or other factors, small sample sizes were considered sufficient for this pilot project. There was considerable discussion on what changes in behaviour we were really looking for and could reasonably expect, ranging from the uptake of various transit packages (relatively easy to measure) to changes in attitude (more difficult to measure), in order to ensure that we didn't waste our time planning to measure the impact of interventions that we were not prepared or able to use in real life.

Many meetings focussed on the information packages and prompts. It was concluded that both depended to a great extent on the specific behavioural changes or actions to be promoted. Attention thus focussed on identifying those actions and the feasibility of using different prompts for different actions versus the lower costs and fewer sampling problems associated with a single, general prompt. Among the suggestions for prompts were various forms of stickers, magnets, Green Points, fridge message board, and key chains. The need for a catchy phrase or logo was raised along with the potential of focussing on children. As the project was to identify practical ways to use CBSM on an operational basis in cities like Ottawa, it was agreed to test only low-cost prompts that could be used in the future with much larger groups, would not require additional personnel to administer, and would not rely on people mailing things back.

In the end, the Committee agreed to use a PageUp© memo holder, combined with an attractive memo card incorporating a two-week diary, as the main prompt. The well-designed, plastic paper weight (with a slot to hold a sheet of paper or card upright) had the project's slogan printed on it using the same colours and font as the memo card. A yellow colour (designed to incite action) was combined with good graphics and a font based on images of people doing exercises. The text on the flyer was revised to include references to co-benefits such as "save money", "stay fit", and "safer streets", and to refer to"new transportation options". A soft but slightly in-your-face slogan, that some people in Ottawa might identify with, was finally agreed upon: Walking the Talk?

Twelve actions initially proposed to be encouraged were whittled down to "10 Simple Steps to Help Improve Air Quality":

1. Walking to where you need to go, instead of driving or being driven?
2. Taking the bus, instead of driving or being driven?
3. Meeting by phone, banking, or shopping on-line, instead of going there in person?
4. Making sure your car is tuned-up, by following the maintenance manual?
5. Biking anywhere for anything, instead of driving or being driven?
6. Checking the pressure in your tires, to ensure that they are properly inflated?
7. Shutting off your car motor to avoid idling?
8. Starting or joining a car pool or sharing a ride instead of driving alone?
9. Helping kids bike or walk to school, instead of being driven?
10. Using a Rack & Roll bus by taking your bike on board?

The information package included the following free or low-cost items:

- Car Economy Calculator (NRCan)
- Fuel Consumption Guide (NRCan)
- Canada's Transportation Challenge (Environment Canada)
- Rack and Roll bike brochure (OC Transpo)
- Bus route map (OC Transpo)
- Cyclist guide map (Region of Ottawa-Carleton)
- Active and Safe Routes to School flyer (Go for Green)
- an EnviroCentre business card.

Those packages without the prompts (yellow memo card and holder) contained an action sheet that would provide people with basic information on the project, including the 10 Simple Steps they were encouraged to take on their own without any prompting, other than a general request:

> "Walking the Talk? can help you **save money, stay fit, and get safer streets and cleaner air** by trying some new transportation options. It's a pilot project of EnviroCentre, a non-profit organization based at Ottawa's City Hall, that is supported by the Region of Ottawa-Carleton, OC Transpo, and the Climate Change Action Fund.

> Please see how many of the actions listed overleaf you and your family can take during the next 2 WEEKS to reduce urban smog and greenhouse gases that contribute to health problems like asthma in children. We'll give you a call afterwards to see what you were able to do to help protect the environment."

Three groups of households were identified for inclusion in the survey (see below). The old Green Home Visit households were randomly selected from the 3,500 conservation pioneers who had received a Visit five years ago; the EnerGuide for Houses households were those that had paid $150 over the last few months for a 2-3 hour home energy evaluation delivered by a representative of EnviroCentre; the new Green Home Visit households were those who received free water conservation devices during a short Green Home Visit delivered by a representative of EnviroCentre in May and June. Those delivering the packages were trained to solicit and record various degrees of commitment from the householders, starting with an agreement to read the package, an agreement to be surveyed a few weeks later, and ending with an agreement to have their names recorded publicly (the last agreement was not mandatory).

Group 1 (old Green Home Visits) = 200 households
50 randoms who would simply be surveyed (control group)
50 randoms who would simply get a TDM package by mail (with a prompt)
50 who agree by phone to get a package by mail
50 who agree by phone to get a package by mail (with a prompt).

Group 2 (EnerGuide for Houses) = 100 households
50 who agree to accept a package (including a prompt), at the end of their evaluation
50 former clients, who received just an EGH.

Group 3 (new Green Home Visits) = 300 households
60 who get no package, no prompt, no spiel (the control group)
60 who get a package, but no prompt and no spiel
60 who get a package, a prompt, and commit to a TDM spiel
60 who get a package, commit to the TDM spiel, but don't get a prompt
60 who get a package, a prompt, but no spiel.

MEASURABLE RESULTS?

Based on a better understanding of the existing markets and resources at our disposal, this project was designed to compare recent take-up rates of traditional conservation programmes with those that have been achieved through CBSM. The theory is that the latter will be much higher, in both the short-term and long-term, and at lower cost, than the former. "Walking the Talk?" is designed to test that theory through participatory, real-life research and provide the data that decision-makers need to plan for future work in this field.

Because the adoption of new behaviours in this field frequently occurs when people who have already experienced them introduce them to friends, family members, or colleagues, one should not underestimate the potential of communicating its results through those who participated in it. In many retail markets, it has long been known that the best kind of advertising is 'word of mouth'. Those people who have already adopted more resource-efficient behaviours, or who have purchased green goods and services, can be the most effective allies because they act as role models in their community, whether it be geographic, social, or work-based. That is why particular attention should be paid to working with conservation pioneers as they will have considerable influence within their varied communities.

By providing balanced information to a sample of Canadians most likely to respond to climate change programmes, and by engaging them in research and demonstration activities, this project was designed to build a foundation for involving many more Canadians in ways that will result in measurable, concrete, and sustainable reductions in greenhouse gas emissions because it focuses on "what Canadians can do at home, work, on the road, and in their neighbourhoods, to build support for the actions of others".

As an alternative delivery service agency, EnviroCentre places high priority on being able to show that it can not only track progress but produce measurable results in a cost-effective way. Unfortunately, the implementation of this project was delayed by a few weeks, and no survey results were available as this paper went to press in the middle of June. They will, however, be posted on EnviroCentre's website (www.envirocentre.ca) when they become available. ❑

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The Change Starts Here:
A Climate Change Employee Awareness Pilot Project

Brad Wallace

Under the leadership of the Office of Energy Efficiency, Natural Resources Canada and Environment Canada, the Government of Canada is developing the Federal House in Order Initiative. One of the early action measures being implemented is The Change Starts Here. *The objective of* The Change Starts Here *is to increase federal government employee awareness about the importance of the climate change issue and encourage them to reduce their greenhouse gas emissions at work, on the road, and at home.* The Change Starts Here *includes a series of awareness tools that appeal to different learning styles. These tools range from a very novel climate change snakes & ladders take-home board game to and on-line awareness tool to a more traditional classroom style workshop.*

Based on pilot testing at both Public Works and National Defence in late February of this year, the program was determined a great success – 96% overall acceptance and 60% participation rates over a two-week period. Come see the awareness tools develop and results achieved.

PRESENTATION OVERVIEW

Climate change is an issue that affects everyone. The Federal Government of Canada recognizes this fact and has therefore signed the Kyoto Protocol with 160 other nations, and committed Canadians to reducing our greenhouse gas emissions by 6% below 1990 levels by the period between 2008 and 2012. In order to meet this commitment, the federal government is participating in the development of a National Climate Change Implementation Strategy and is implementing a number of greenhouse gas emission reduction initiatives.

One of the early climate change initiatives that the federal government has implemented is *The Change Starts Here* climate change employee awareness pilot project. Under the lead of the Office of Energy Efficiency, Natural Resources Canada and Environment Canada, the objectives of the pilot project were to do the following.

- Develop a series of awareness tools that would increase federal government employee awareness about climate change and encourage them to reduce their greenhouse gas emissions while at work, on the road, and at home.
- Implement the tools in two "representative" pilot facilities.
- Evaluate the effectiveness of the awareness tools in order to propose and make recommendations for further improvement prior to a full roll-out in other federal government departments and facilities.

The awareness tools were delivered through a variety of media and appealed to a range of learning styles. The tools are a senior management briefing session, e-mail messages, posters, a lobby display, bookmarks, an Internet Web site, an on-line awareness tool, an employee orientation workshop, a take-home board game, a collector's series of trivia cards, and an action pledge form.

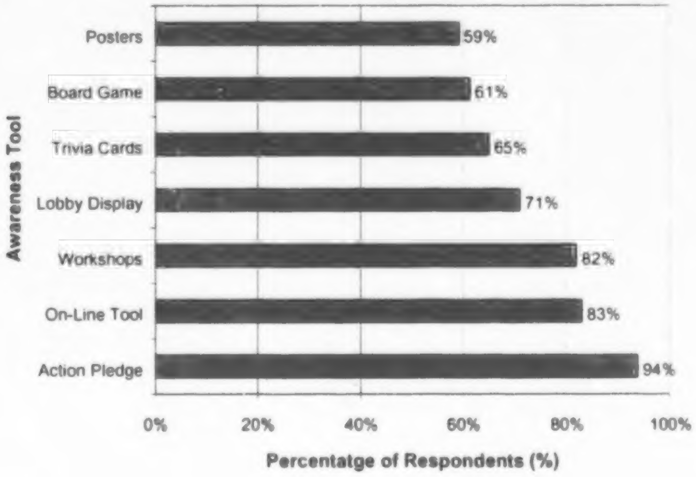
The two pilot facilities were: Tower A1 in Phase III of the Place du Portage complex in Hull, Quebec, which houses numerous Public Works and Government Services Canada (PWGSC) service and branch offices; and the Department of National Defence (DND) headquarters facility located in the Major-General G. R. Pearkes

Building in Ottawa, Ontario. The dates for the pilot tests were February 28 to March 3, and March 6 to 10, 2000 for the PWGSC and DND facilities respectively.

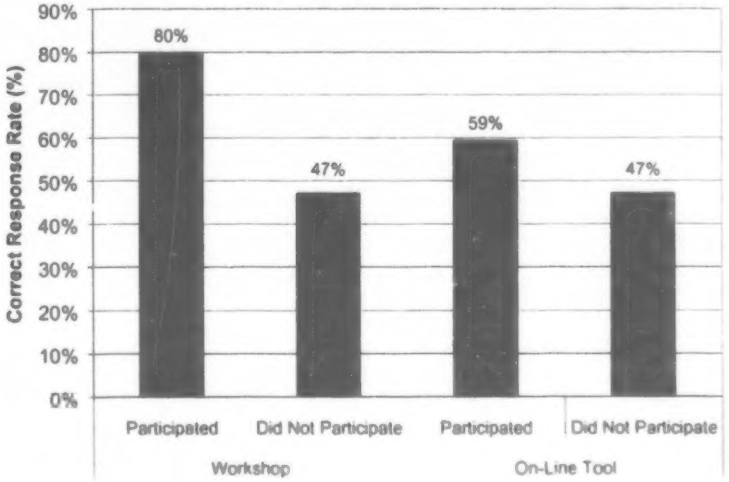
Three instruments were used to measure the effectiveness of the various The Change Starts Here awareness tools. They were telephone surveys before and after the delivery of the pilot project, an entry and exit quiz and database that are built into the on-line awareness tool, and direct observations.

The results from *The Change Starts Here* pilot project were generally very positive. Over 95% of the survey respondents indicated that they agree or strongly agree that the federal government should continue to develop

EMPLOYEES THAT RATED THE TOOLS AS EFFECTIVE AND VERY EFFECTIVE



WORKSHOP AND ON-LINE TOOL USER AND NON-USER FAMILIARITY WITH THE CLIMATE CHANGE ISSUE, THE KYOTO PROTOCOL AND GOVERNMENT COMMITMENT



and implement programs that increase employee awareness about climate change.

Approximately 485 PWGSC and 290 DND employees visited, attended, and/or used the lobby display, workshops, on-line awareness tool, or Internet Web site, which are considered as the principal awareness tools. Over 6,700 take-home board games, collector's series of trivia cards, bookmarks, action pledges and various governmental climate change and related program publications were distributed at the display, workshops, and on the floors in the pilot facilities.

It is estimated that the overall participation rates for *The Change Starts Here* were **78%** for PWGSC and **42%** for DND respectively and that the average participation rate for both facilities was **60%**.[1]

Specifically, the on-line awareness tool quiz and telephone survey were used to measure the difference in employee awareness and behaviour before and after being exposed to the various awareness tools as well as employee perceptions about the tools. A sample of the results are described and illustrated below:[2]
* most of the employees that used the awareness tools, indicated that they were effective or very effective at increasing awareness about climate change; and
* after using the on-line tool or participating in a workshop, employees became more aware of the climate change issue in general, and specifically of the Kyoto Protocol and the federal government's commitment to reduce greenhouse gas emissions.

When asked why they did not participate in The Change Starts Here pilot project, many individuals indicated that they did not know about it and/or they did not have the time to participate, particularly at the end of the fiscal year. Other individuals indicated that they were not interested, "already knew everything" about climate change, felt that that they could not make a difference, or that they were not comfortable using "work" time to participate in "non-work" activities. Many respondents offered suggestions for increasing participation. These suggestions included the following:

- making attendance mandatory, "like the (programs) about sexual harassment";
- increasing senior management support and participation,
- targeting specific floors or operational areas when inviting employees for the workshops and using rooms that are physically closer to the targeted employees to deliver the workshops; and
- making the impacts of climate change "personal" by using more examples and images of the environmental, human, and financial impacts of climate change. ❑

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[1] This result was obtained by adding the number of employees that used the principal awareness tools and the number of employees that received at least one of the distributed materials. However, the number of employees that visited the display and participated in the workshops is not included in the estimate since these employees are included in the number of employees that received the distributed materials.

[2] In all cases, the results for employee perception, and impact on awareness and behaviour are based only on the responses from employees that used the tools.

Lessons Learned from the Blue Box Recycling Program

Hélène St. Jacques

Ontario's Blue Box recycling program has been a stunning success. Within a decade most Ontario householders have been converted from being garbage disposers to waste diverters. By 1998, 3,850,000 of Ontario's 4,238,000 households had access to the program with a participation rate of 90%. A total of 1,841,000 tonnes of household materials were recycled or otherwise diverted from the waste stream in 1998 alone. This example prompts many questions that are germane to the massive attitudinal and behavioural changes required to address climate change. What were learned from the success of Blue Box recycling that can be applied to climate change?

INTRODUCTION

As a starting point let's examine the period when recycling was introduced in 1981 in Kitchener, Ontario. It was launched in response to local pressure to take decisive action to reduce waste. In 1985 and 1986 the Ontario government endorsed the program and it was rapidly launched in municipalities throughout the province. The blue box program was named after the distinctive bright blue plastic bin that was distributed to participating households, namely those with access to curbside recycling. (Apartment recycling was introduced as the program evolved; achieving recycling efficiencies in multi-unit residential buildings continues to pose a considerable challenge.) The operational elements were developed, tested and refined through experimentation - system designers learned as they went along given the program's unique nature. As news of this innovative method of reducing household solid waste spread, more municipalities got on board, usually prompted by local environmentalists and activists.

Two elements were critical in the growth of blue box recycling - firstly, the desire of householders to participate in reducing their solid waste stream and secondly, funding. The municipal start-up recycling programs received tripartite funding from the provincial environment ministry, the participating municipality and an industry association (Ontario Multi-material Recycling Inc., mainly representing the soft drink industry). In return for providing start-up funding for the blue box recycling program, the Ontario government permitted Ontario soft drink manufacturers to market their products in non-returnable containers. They were not required to introduce a deposit-return system. Rather, the plan was to retrieve these containers, and other materials, in the blue box recycling program. The core materials that were initially collected were newsprint, glass containers and steel and aluminum cans.

Now we will focus on household participants - why were they eager to divert some of their waste material? Polling conducted at that time found that the majority of the population was concerned about the state of the environment - usually the focus was on air and water pollution and loss of forests and wildlife. Nonetheless, blue box recycling was introduced at the right time and tapped into a strong desire to reduce the visible impact of consumerism. It provided a way to perform an environmentally good act, with a minimum of inconvenience - the end result for the participant was guilt reduction. Much to the surprise of the municipalities who introduced blue box recycling, householders enthusiastically trained themselves to separate their waste. Contrary to the adage, the old dogs were willing to learn new tricks. Indeed, the municipalities were overwhelmed by the

Text continues on page C4--15

KEY VARIABLES	RECYCLING	CLIMATE CHANGE
The problem	Canada produces the most waste per person, 2.2 kg per day	Canada is the 2nd largest per capita producer of greenhouse gases. Emissions are growing by 1.5% per annum
Individual or Collective Action?	Individual and household response. demand industry and government participation Community-based programs developed by local government - shaped and delivered by local government	Individual choices Intervention possible on every level but mainly provincial and federal issue
Voluntary Role	Yes, in most communities but mandatory recycling (user-pay) prompts more diversion Higher diversion will require user fees	Yes, no social or financial penalties
Availability	Universal availability but flawed multi-unit programs	Depends - urbanites have more transportation options Energy deregulation introducing new renewable sources (solar, wind, etc.)
Social Pressure	Very strong from other household members, particularly children play major role in shaping adult behaviour. Parents feel a sense of heritage and responsibility. Neighbours take note of who and who does not recycle; pressure to conform.	Very little/none. Popularity of SUV's and vans totally ignores air quality and energy consumption issues. Love affair with the car, major status symbol
Degree of convenience	Very, for curbside recyclers - less for apartment Convenience main contributor to convenience	Not, for suburban and rural dwellers Urban sprawl major contributor to problem
Degree of behavioural change	Considerable but it quickly becomes routine and normative	Massive, particularly regarding transportation
Historical precedents/ Antecedents	Yes, depression/pre-WWII Normative in developing countries and some European countries	None recent. 19th century horse and buggy
Role of media	Local media effective carrier of advertising Editorial critical of recycling - few positive references	Extols virtue of auto power - heavily advertised Some denial of global warming/climate change Failure to educate science illiterate public
	Popular culture quickly absorbed recycling metaphor	
Link with environment	Strong, major act for the environment Helps connect behaviour with values	Not broadly seen as anti-environment - love affair with the car dominant
3Rs Heirarchy	Bottom level, easier than re-use and reduction. Widely known 3Rs pyramid of change	Reduction means drastic behaviour change - hardest action
Government Response	Clear signals of support from all levels - "motherhood" issue Federal endorsement - paper recycling and procurement policies Provincial level set 50% diversion target for 2006	No clear signals, some denial and obstruction - overall leadership vacuum Federal government has not ratified Kyoto commitment to reduce emissions by 6% by 2008 and 2012 based on 1990 levels Ontario Drive Clean program a poor start Toronto Atmospheric Funds - model program

	BLUE BOX RECYCLING	CLIMATE CHANGE
Impacts	High public awareness of impacts - wasted finite and renewable resources Closure of many old dumps; no new landfill sites created forcing municipalities to look for new solutions Removable of easy items now leading to hard ones - organics and household hazardous waste Guilt for wasteful consumerist behaviour - trend towards re-use, pass-along (new homes for old stuff)	Low public awareness of damage 6,000 premature deaths per annum in Ontario - doctors declare air pollution as a public health crisis 8% (16,000) of non-traumatic deaths PA in Canada due to air pollution, children and elderly main victims 20% increase of infants admitted to Ontario hospitals for pneumonia, bronchitis with higher ozone and sulphate levels
Clarity of Issue	Easy to understand/ palpable/it is bad to throw away things that could be reused - waste not want not! Conserving, helping environment, giving back, trend to re-use and pass-along i.e. yard sales Major perceptual shift - recycled content now as good as virgin	Not at all/no link between behaviour and environmental impact. Pass along blame to others i.e. industry Assume it is linked with the weather, not human behaviour Climate change too general, meaningless, confusing
Role of Industry	Major role in recycling/waste reduction and using recycled content in closed loop processes - still voluntary Legislation needed to force re-use and recycling	Dragging heals - denial and threats Resist making meaningful changes
Economic Impacts	Public believes reducing waste and using recycled content is good for business Creates new jobs and development of new technology Direct increase in municipal taxes	New technology creates new jobs and saves money - little innovation evident to date Public endorses new development but many unwilling/unable to pay premium for new green energy None/little that is widely noted
Obstacles	Negative/indifferent media Lack of green alternatives (reduced packaging, recycled content) Limited/insufficient municipal education	Many - don't understand nature, causes and consequences Too complex and obscure - low personal connection Low awareness of personal impact & solutions
	Hurdles of multi-unit programs - no ownership Indifference of youth	Lack of danger and immediate impacts Lack of control, unlike recycling Desirable status of high energy use - a goal for many - price will not deter (to some extent)
Messages/ symbols	Blue Box is the recycling ikon - wide recognition Mobius loop on packages and products helps and rewards recyclers	None

SOLUTIONS/OPPORTUNITIES

RECYCLING - WASTE REDUCTION	CLIMATE CHANGE/GLOBAL WARMING
More recycling (prompted by user pay) Remove more/all organics from the waste stream Focus attention on growing waste categories: used computers and household hazardous waste Create effective multi-unit bldg. programs Greater manufacturing use of recycled materials Introduce full costing accounting Celebrate status of being virtuous & environmental	Education - individuals/families produce 31% of GHG emissions - 45% transportation, 33% space heating, 7% water heating, 9% appliances and lighting, 6% waste Promote - alternative, renewable sources of energy - electric and low energy cars and heating (solar thermal panels, wind, natural gas). Switching people to new technology possible if it can deliver the same benefits, including being user-friendly, convenient, easy to access and the same price or close to it. NO SILVER BULLETS/TECHNO SOLUTION FOR CARS - toll roads, higher fuel cost and insurance premiums - behaviour change will happen when they "feel the pain" Promote ways of reducing energy (home and transportation) Reward fuel economy and introduce higher gas prices (half of European prices) Focus more on renewable fuels (ethanol) Promote benefits of locally bought, seasonal food and low/no processed food. Eat lower on food chain Link with air pollution, major, unexpected weather events and disappearing bird and animal habitat - high concern areas
Public wants recycling - political suicide to cut it	Public pressure needed - need for climate change heroes

KEY MESSAGES

RECYCLING	CLIMATE CHANGE
Two Waves - information to new recyclers and feedback for seasoned participants Maintenance - reminders and reinforcement	Behaviour changes will not happen without 'carrots and sticks' - societal endorsement and financial incentives Fear based messages (freak storms, shortages) have a role but should not be dominant - Atmos-Fear (Faith Popcorn) term for fright caused by E. coli, mad cow disease
Stating the problem - cause and effect - easy to understand	Stating the problem is complex - cause and effect not known by most Focus on key points Simplify message to expand awareness Provide alternatives and promote positive impacts
The blue box is the symbol of environmental good Mobius loop alerts consumers of content and impacts of recycling - the loop has been closed	Create a central image/symbol/visual link and promote vigorously

volumes of recyclables that they collected at curbside in the blue box. As a result, initially the system was choking with an excess of recyclables. And, because it was early days the closed loop system was full of gaps, consequently the materials were stockpiled awaiting market development which would ultimately result in remanufacturing these items into new products and packages. This part developed more slowly given market values that priced virgin materials at lower cost. This economic reality still applies and will not be remedied until full cost accounting has been introduced.

At the outset, program designers focussed on operational elements and development of markets for the recyclables. Public education was minimal - novice recyclers were given a recycling bin with a list of recyclable materials and the pick-up schedule. There was no large scale communication or promotional program, rather the news was carried by word-of-mouth and local media. Guilt and social pressure from neighbours and child adopters were the main stimuli to change wasteful behaviour. Rapidly, the blue box quickly became an ikon for environmental good.

It is noteworthy that the media generally has been critical of recycling. More often than not, journalists have found fault with the program; overall it has received more negative reports than accolades. This is one instance, were the media was totally out of step with public opinion - people loved their blue box and the media loved to hate it. However, savvy politicians quickly realized that recycling was immensely popular and that it would be political suicide to withdraw support from the program. Consequently, municipal and provincial elected representatives have been supportive.

Having established this background, I shall proceed to a comparison the blue box recycling and climate change, based on a list of major variables. In order to simplify and summarize this comparison, this information has been distilled into a series of tables, as follows.

There is no doubt that the task of creating widespread awareness of the causes and impacts of climate change will require massive public education. Dedicated, experienced teams of social marketers and sensitive message creators will be needed to work with scientific experts. Together multidisciplinary teams should develop clear messages and realistic strategies aimed at the diverse target audiences. The evolution of public awareness and behaviour can be moved in increments - shifts must be monitored and messages then must be developed to build on existing learning. All successful change initiatives i.e. drinking and driving, adoption of seat belts, smoking cessation, etc. have occurred over a period of time. The tide can be turned but can only move gradually, given the profound changes that are required to alter energy consumption.

The knowledge front and meaningful changes in behaviour can only occur if there is widespread acceptance that climate change is a clear and present threat. This means that all levels of government and the business community must work together and be seen to work together by the general public. Climate change is a shared problem and must be treated as such. Great strides can be made if there is consensus on the solutions and public will to address the issue. ❑

Taking Residential Energy Efficiency to the Streets: What Gets the Public Involved?

Ryan D. Kennedy, Paul Parker, Ian H. Rowlands and Daniel Scott

This paper assesses the relative effectiveness of different social marketing techniques to recruit public participation in the national EnerGuide for Houses programme within in the study area of Waterloo Region, Ontario, Canada. This programme is offered to local residents as a means by which they can reduce home energy costs, improve home comfort and lower greenhouse gas emissions. In the first year of the project, approximately 900 households participated. A number of different marketing strategies were utilized to engage the public. With consistently higher rates secured by community-based strategies, the importance and cost-effectiveness of stakeholder participation at the local level is clearly demonstrated.

INTRODUCTION

The Residential Energy Efficiency Project (REEP) is based at the University of Waterloo (UW) and is a joint project of the Elora Centre for Environmental Excellence (ECEE) — a local non-profit Environmental Non-Governmental Organization (ENGO) — and the Faculty of Environmental Studies at UW. This project conducts comprehensive *EnerGuide for Houses* home energy evaluations in the Regional Municipality of Waterloo, collects technical data on the house structure, attitudinal and behavioural date via a social survey and delivers educational material on climate change issues. Equally important to the applied programme delivery is the comprehensive research component of the project. This social marketing analysis is one element of that broader research project.

REEP uses the residential energy efficiency evaluation tool *EnerGuide for Houses* (EGH).[1] This tool builds on the public visibility and profile of the *EnerGuide* rating system currently used to label the energy efficiency of household appliances. EGH uses a computer-modelling programme (Hot2XP) to determine where structural and mechanical energy losses are occurring in the house and what the relative energy savings would be for possible renovations or home modifications. A report is given to homeowners, which describes these findings and recommendations. This advice empowers homeowners to improve their home comfort and reduce heating and cooling costs. REEP began evaluating homes in the Waterloo Region (Figure 1) in May 1999. By the end of April 2000, there had been approximately 900 home energy evaluations conducted.

The overall goal of the Residential Energy Efficiency Project is to help build healthier, more sustainable communities. The residential sector represents a significant opportunity for reduced greenhouse gas emissions. By 2010, emissions from Canada's residential sector are forecast to grow 16% above 1990 levels. If Canada's commitment to reduce greenhouse gas emissions by 6% (versus 1990 levels) is applied equally across each sector, the residential sector will need to reduce overall emissions by 20%. Based on an analysis of the first 557 homes evaluated through the Residential Energy Efficiency Project, it has been determined that an average household could reduce emissions of CO_2 from 17.3 tonnes/year to 13.7 tonnes/year – a 21% reduction. Improving this sector's efficiency moves the community towards being more sustainable and helps Canada's meet international commitment.

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[1] The Office of Energy Efficiency, in the federal department of Natural Resources Canada (NRCan), developed EGH.

The primary challenge for the project has been on how to recruit participants to have their homes evaluated. Using a variety of social marketing techniques, homeowners are recruited throughout Waterloo Region. Minimal funds were spent on actual marketing materials, with a focus on direct contact with citizens in the community. The principles of Community-Based Social Marketing were used where possible and several experiments were designed to compare and contrast the relative effectiveness of different marketing efforts.

COMMUNITY BASED SOCIAL MARKETING

Community-Based Social Marketing (CBSM) is used to help deliver programmes that require the removal of barriers to achieve a behavioural or attitudinal change (McKenzie-Mohr, 1999). CBSM can be particularly effective in building a healthy, sustainable community because often barriers to sustainability require actions at the personal level. CBSM combines aspects of social psychology and traditional marketing. Research in social psychology indicates that efforts to promote behaviour change are "often most effective when they are carried out at the community level and involve direct contact with people," (McKenzie-Mohr, 1999).

McKenzie-Mohr (1999) has outlined the stages of the CBSM approach:

- identifying the barriers to a behaviour;
- developing and piloting a programme to overcome these barriers;
- implementing the programme across a community;
- evaluating the effectiveness of the programme.

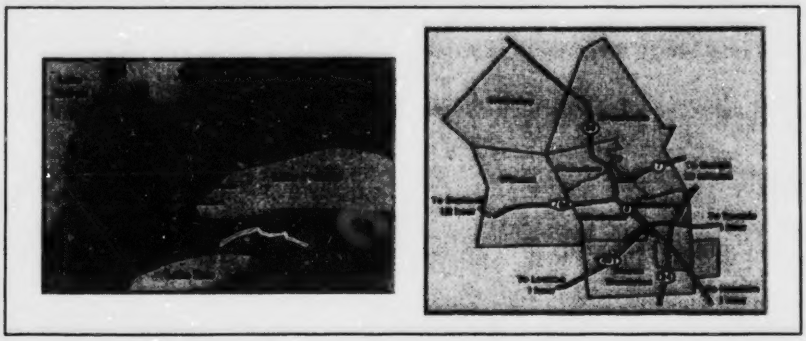
REEP'S COMMUNITY-BASED SOCIAL MARKETING APPROACH

Identifying the barriers to participating in the REEP project was done using a literature search of other residential energy efficiency projects and through an in-house focus group, which involved students and faculty from UW. It was suggested that the following would be barriers to participating in REEP:

- Cost to homeowners
- Time commitment of homeowner
- Trust – a faceless, unknown organization – lacking credibility
- Efficacy – the sentiment that actions taken by the homeowner will not make a real difference (to costs or the environment)
- Homeowners feel they already know what's wrong with their home's energy efficiency.

The project's overall design considered each of these barriers. Marketing materials also addressed these barriers. Because REEP is not only a community-based energy efficiency initiative, but also a research project, no specific pilot programme was developed — rather a series of ongoing experiments were conducted and results tracked.

FIGURE 1
Location of Waterloo Region (Ontario, Canada)



BARRIERS

The cost barrier was addressed by obtaining significant funding partners to offer a low price that would ensure the programme was accessible by households of all income levels. Core funding for the project was derived from a two-year grant from the federal government's Climate Change Action Fund. At the community level, local government (Region of Waterloo, Cities of Waterloo, Cambridge and Kitchener) and utilities (Union Gas and Cambridge North Dumfries Hydro) also provided financial support. This funding made it possible to provide the EGH evaluation service to homeowners for $25, compared to $100-$190 in most other Ontario communities.

The time barrier was addressed by designing a project that could complete the entire home energy evaluation in approximately 2.5 hours. This was accomplished by pairing a University of Waterloo co-operative education student with a nationally certified home energy advisor to speed data collection. Each evaluation team was provided with a portable laptop computer and printer that enabled reports to be printed in the home. Other programmes have only a single home energy advisor conducting the evaluation, without a portable computer. This requires the report to be completed off-site and either a second visit scheduled to deliver the report or the report be mailed to the homeowner. The latter precludes the opportunity for the one-on-one discussion of the findings, considered crucial to uptake of the recommendations.

The barrier of trust was addressed by basing the project at the University of Waterloo — a well-known, respected institution in the community. Local partners, like the cities and regional government, also helped bring a recognizable image or name to the project to help overcome the "faceless" or unknown aspects of the project. Furthermore, the project is using the *EnerGuide for Houses* national programme, which includes the *EnerGuide* symbol — a graphic familiar to many Canadians (see Figure 6).

Survey results (n=386) indicate that 86% of respondents want either a University/College or a local non-profit environmental organization deliver home energy evaluations. Presumably these institutions are trusted to provide unbiased advice without benefiting directly from any future upgrades or renovation work.

The efficacy barrier of "it won't make a difference" was addressed through marketing efforts that emphasized what the average home in Waterloo Region could expect in terms of energy and cost savings. Previous studies were quoted regarding emission reductions, energy cost savings and increase in the resale value of the home after energy efficiency work.

The barrier of "I already know what's wrong with my home" was addressed in marketing messages that emphasized the national certification process and the professional "home performance experts" – to highlight the special skills used in this energy evaluation. Marketing materials and public outreach efforts also emphasized the value of having the EGH label even if the problems in the house were known or the house was highly efficient. Being able to quantify the home's high-energy efficiency rating (via the EGH rating sticker) to future homebuyers was promoted as an additional marketing advantage for the homeowner.

TAKING THE MESSAGE TO THE STREETS

It should be noted that while the marketing of REEP was taking place throughout Waterloo Region, other marketing efforts were also being implemented through the federal government's nation-wide marketing of EGH. In this situation it is possible then to compare the effectiveness of the federal and REEP designs. All materials designed and created for the promotion of the national EGH programme were available to the Residential Energy Efficiency Project. In each case, REEP developed its own community-oriented versions of marketing material and compared the relative effectiveness of the federal-focussed materials.

Natural Resources Canada (NRCan), more specifically the Office of Energy Efficiency, designed promotional pamphlets, posters, inserts, newspaper advertisments and television commercials. The NRCan material was well designed, descriptive, colourful and included contact information (a 1-888 number and a local Kitchener/Guelph phone number). In NRCan's material, EGH is depicted as a broad national programme with the information clearly presented as a federal initiative.

REEP materials had a very different visual appearance and message. Contrary to marketing principles that argue colour is needed to get people's attention, REEP used plain, non-bleached, post-consumer recycled paper. Furthermore, the REEP materials highlighted the community focus including:
- the project's relationship with the University of Waterloo
- the need to help the local environment
- the link to local governments
- the project is part of a national programme but available for residents of Waterloo Region through a community-based partnership.

In addition to testing the relative effectiveness — both in terms of ability to recruit participants and cost — of the federal and community-based marketing materials, the project also examined the value of Geographic Information Systems (GIS) analysis to identify neighbourhoods for target marketing.

Based on programme evaluation literature on the Green Home Visit programme in Ontario and other residential energy efficiency programmes in Canada and the US, six factors were determined to have a potential impact on programme participation (income, education level, recency of house purchase, house age, ownership and condition of house structure). Using census data from 1996, the six criteria (with specific thresholds) were used to determine the relative likelihood of participation in the programme in any given enumeration area:
- The average household income is at least $60,000;
- At least 40% of the households have a family member who has received a university degree;
- At least 50% of the families have moved in the last 5 years;
- A minimum of 80% of the households were built in 1970 or earlier;
- At least 85% of the households are owned;
- A minimum of 10% of the households require major repairs.

Each criterion was given equal weighting, considering each factor would be equal in improving the likelihood of participating in the project. Enumeration zones that matched all these criteria were rated "Highly Suitable". Zones with no matches were considered "Not Suitable" (Figure 2). Highly rated neighbourhoods, most likely to benefit from the programme, were priorities for direct marketing.

COMPARISON OF MARKETING RESULTS

Throughout the first year, all homes evaluated were asked how they heard about REEP These records were then used to compare how effective different marketing efforts were at encouraging homeowners to phone and book a home energy evaluation. In this comparative analysis, 891 homes are classified as hearing about the project from one of the five marketing initiatives: Community Based Meetings, Community Based Events, Media, Direct Marketing, and Passive Marketing.

Community Based Meetings included presentations to schools, service clubs, Boards of Directors at housing co-operatives and other formal, structured events. **Community Based Events** included festivals, environmental fairs, public gatherings or lectures. In total, over 46 outreach initiatives were conducted during the first year with attendance at these Community Based Events and Meetings reaching over 4,000 people.

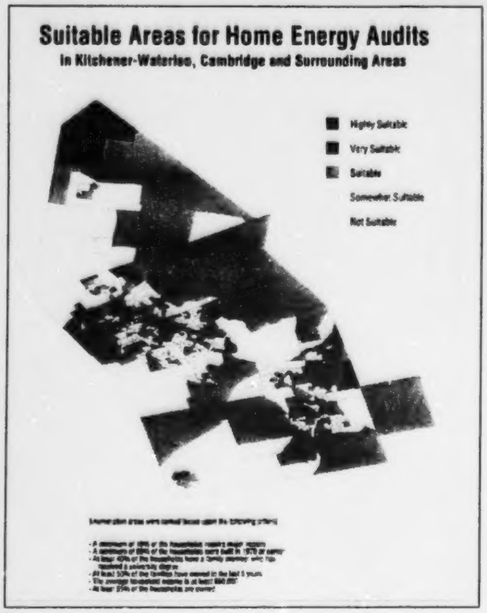

Suitable Areas for Home Energy Audits
In Kitchener-Waterloo, Cambridge and Surrounding Areas
Highly Suitable
Very Suitable
Suitable
Somewhat Suitable
Not Suitable

FIGURE 2
GIS Analysis of Target Neighbourhoods in Waterloo Region

Community Based Meetings resulted in 129 evaluations over the first year. The majority of these bookings (74% or 96 evaluations) were from two housing co-operatives that arranged to have most of their units evaluated. Community Based Events resulted in 57 evaluations being booked. Of the 17 events attended, 10 resulted in evaluations being booked, however 74% of these (42) were from three events.

Marketing using local **Media** included three television appearances and ongoing commercials on *The Weather Network*, 25 print articles and 3 radio interviews. In total, media coverage resulted in 267 evaluations being booked.

Print articles included an article in a major daily, several community or neighbourhood papers, UW publications and company newsletters (including electronic or email versions of company communications). Print media resulted in 153 evaluations being booked. Although there were 25 print media articles, 73% of bookings came from only 5 pieces, and 100% from 14 pieces.

NRCan took out half-page ads in a local newspaper for two consecutive Saturdays in March 1999. These ads described the national EGH programme, listed a 1-888 contact phone number, and included a price of $100. These two ads cost approximately $9250 (Kerk, 2000) and resulted in no calls or bookings being made. It is possible that no one responded to the federal-oriented advertisements because of the larger price barrier or the "faceless organization" issue, since an office in one federal government department would be less identifiable than the local university. It is impossible to state what barrier needed to be overcome without further research.

Television coverage included a news item on the local CTV carrier's 6 o'clock news in October 1999 (resulting in 74 evaluations), and a community focus story on the CTV carrier's noon news in January (resulting in 31 evaluations). Coverage also included an interview on the local cable *community access show* in February (resulting in no evaluations). A Canada-wide ad campaign on *The Weather Network* included commercials for the national EGH programme and included a 1-888 number interested viewers could call. Standard month long ad campaigns (six 30-second spots a day over four weeks) on this network cost approximately $30,000 (not including production costs). Two evaluations were booked in Waterloo Region through this marketing initiative, versus 105 through local TV coverage that had no cost to the project.

Radio coverage included a half-hour show on UW Campus Radio, a short spot on local talk radio (570AM) and a province-wide promotion for EGH on CBC's Ontario-Today phone-in. This province-wide initiative involved representatives from the Green Communities Association, the umbrella organization that the Elora Centre for Environmental Excellence belongs to. The CBC spot was not a REEP initiative, rather a broad EGH marketing promotion. In total, radio resulted in seven evaluations - five from REEP efforts and two from the Green Communities Association's interview.

Direct Marketing included deliveries of marketing pieces to test neighbourhoods, one mass distribution of 20,000 pieces and the delivery of notices to neighbours of homes being evaluated. Several experiments were conducted through the direct marketing efforts, including the comparison of response rates to local (REEP) materials to nationally designed promotional material (federal NRCan material). In total, Direct Marketing generated 98 evaluations in the first year.

Over a series of months, six neighbourhoods were used as test areas. These neighbourhoods were selected using the GIS analysis, which identified homes of similar suitability for home energy evaluations. Over four days during the end of November 1999, homes in three of these neighbourhoods received REEP pamphlets while homes in the other three other received NRCan pamphlets.

The pamphlets are of similar dimensions and paper quality, each with three panels printed front and back (see Figures 3 and 4). The NRCan pamphlets, which were in colour, listed no price and included contact numbers throughout Ontario — including a phone number for the Kitchener/Guelph area. The REEP pamphlets included graphics for the University of Waterloo, the Elora Centre for Environmental Excellence and local partners including

FIGURE 3
REEP Pamphlet

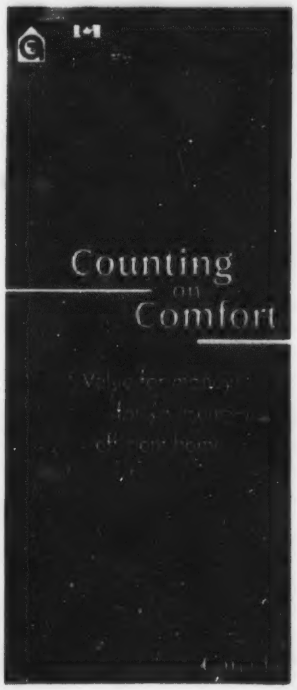


FIGURE 4
NRCan Pamphlet

the City of Cambridge.

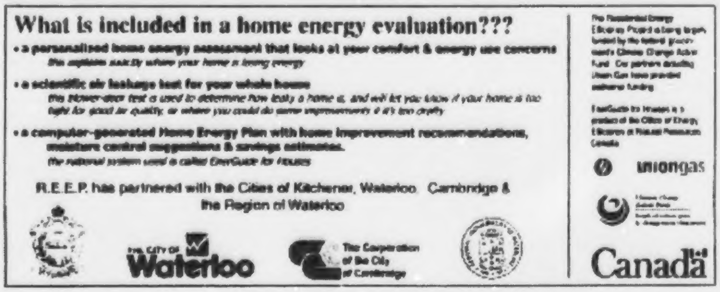
In total 1117 NRCan pamphlets were delivered between the dates of November 24-27, 1999. REEP pamphlets were delivered to 912 households between the dates of November 26-27, 1999. The NRCan pamphlets resulted in no phone calls or bookings. The REEP pamphlets resulted in five evaluations being booked. The same neighbourhoods were visited in January 2000, however the homes that had received a REEP pamphlet were given NRCan pamphlets, and the homes that had previously received a NRCan pamphlet were given a REEP pamphlet. The NRCan pamphlets resulted in zero evaluations, and the REEP promotions resulted in 29 evaluations. This finding demonstrates the need for a "double-hit" or multiple exposure to an idea before an attitude or behaviour is changed.

A sample neighbourhood was also direct marketed to in the "Not Suitable" zone according to the GIS analysis. On February 24, 2000, 421 REEP pamphlets (see Figure 3) were delivered resulting in zero evaluations. On February 23, 2000, 432 homes were delivered a REEP pamphlet in the "Highly Suitable" zone, which resulted in 7 evaluations.

Other direct marketing efforts included a mass distribution for flyers to 20,000 homes. The local Saturday flyer (that includes items for sale, events and work opportunities) was used to deliver these pieces. Again, a local-national material experiment was conducted with neighbourhood type controlled for. A REEP insert was delivered to 10,000 homes in "Very Suitable" and "Suitable" zones (see Figure 5). The glossy, bilingual NRCan insert (see Figure 6) was delivered to 10,000 different homes, also in "Very Suitable" and "Suitable" zones. The NRCan insert resulted in nine evaluations being booked while the REEP insert resulted in 31 evaluations. These findings again emphasize the role of 'trust' versus 'colourful, professional design' in this type of programme.

Towards the end of the first year, a **"Dear Neighbour" letter** was designed (see Figure 7), which used traditional

FIGURE 5
REEP Insert

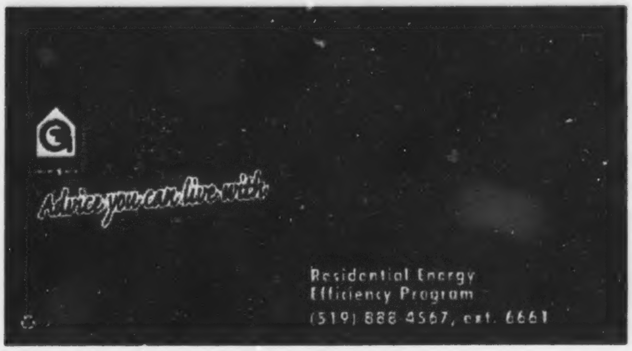


What is included in a home energy evaluation???

- a personalised home energy assessment that looks at your comfort & energy use concerns
- a scientific air leakage test for your whole house
- a computer-generated Home Energy Plan with home improvement recommendations, moisture control suggestions & savings estimates.

R.E.E.P. has partnered with the Cities of Kitchener, Waterloo, Cambridge & the Region of Waterloo

FIGURE 6
NRCan Insert



CBSM techniques. The generic pamphlet, although appropriate for direct marketing, was not designed specifically for door-to-door delivery. The Dear Neighbour letter began to be distributed in mid-March 2000. This resulted in 17 evaluations by the end of April 2000. It is worth noting that appointments were booked approximately 2 months in advance in the winter and Dear Neighbour Letters are a leading source of evaluations in the second year of the project.

Passive Marketing generated 21 evaluations during the first year. Initiatives in passive marketing included using REEP posters (see Figure 8), signs, car magnets and leaving pamphlets in key locations around the region. Posters were hung in schools, government offices, stores, a bowling alley, libraries and private offices. Pamphlets were often left with posters and were also distributed throughout the region at coffee shops, bookstores, clothing stores, museums and art galleries.

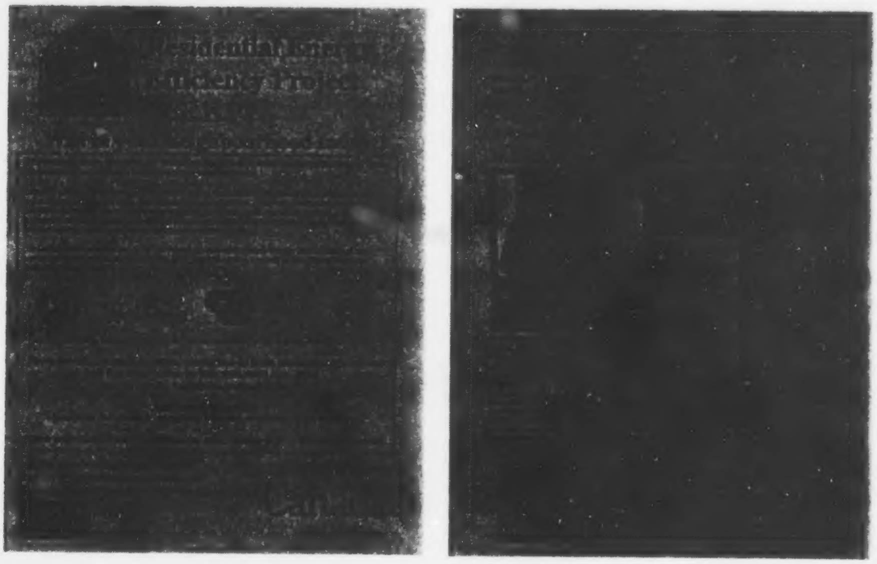
The results of the various marketing initiatives are demonstrated in Figure 9. Referrals represent the most significant source of evaluations, followed by Media sources and Community Based Meetings.

THE EFFECTIVENESS OF REEP's CBSM PLAN

To determine how effective REEP has been at addressing barriers through its CBSM plan, it is useful to compare the project with other EGH projects throughout Ontario. Figure 10 shows the number of evaluations conducted in each community between October 1999 and January 2000.

REEP's CBSM approach resulted in the participation of just over 275 households in this time frame. The only other project with a similar level of participation was the GreenSaver project in the City of Toronto. This project relied on commercial partners to distribute a high volume of high-cost marketing materials (a Utility customer mail-out). This single marketing initiative resulted in significant interest. Over 500 evaluations were conducted, largely as a result of this promotion in which began in October 1999. However, as the effect of this single marketing strategy diminished, participation has decreased substantially. For example, in May 2000, GreenSaver conducted only 22 evaluations (versus REEP's 130). In short, REEP's ongoing CBSM appears to be more a

FIGURE 7 — Dear Neighbour Letter, Front and Back



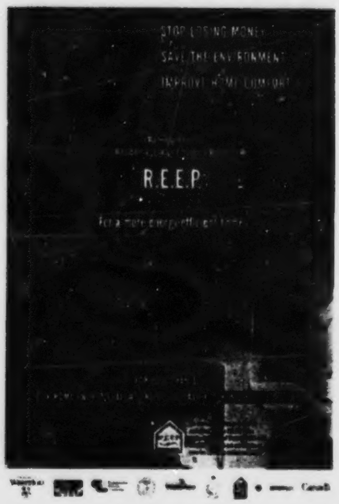


FIGURE 8 — REEP poster

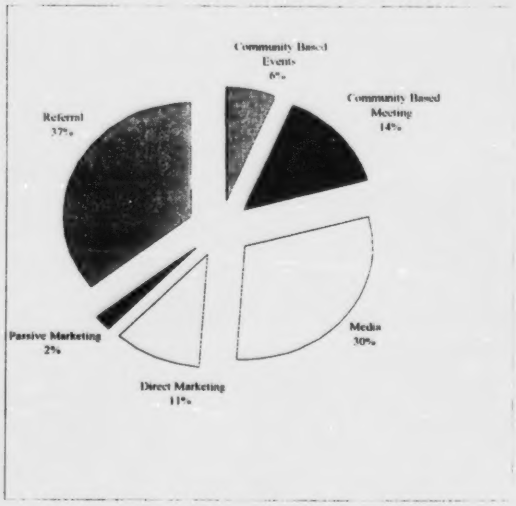


FIGURE 9 — Sources of Evaluations (n = 891)

more sustainable long-term approach.

Comparison with the Toronto GreenSaver programme also indicates that success of REEP to attract widespread participation in the community. Although the Toronto project does not have socio-demographic data for direct comparison, the average house size evaluated serves as a useful proxy for household income. The average house size evaluated by GreenSaver was 3300 ft^2, or 43% larger than the average REEP house (2300 ft^2). The cost barrier identified initially in the design of REEP's CBSM approach appears to have been addressed. Clearly, it is mainly higher income homeowners who are willing to pay the $150 fee for an EGH evaluation in Toronto.

CONCLUSIONS

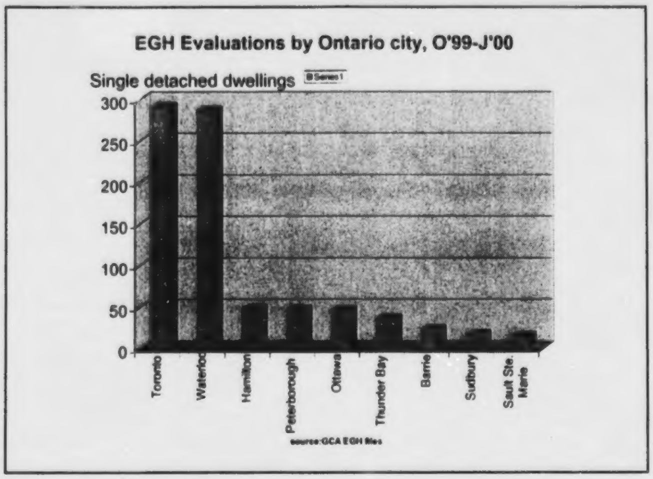
Community-Based Social Marketing is an effective means to engage the public in participating in the Residential Energy Efficiency Project. The CBSM approach has been effective at attracting a steady level of interest necessary for a sustainable programme. It can be concluded that the community approach — local vs. federal — appears to be significantly more successful in terms of engaging the public in this programme. CBSM is also significantly more cost effective for a programme of this nature, than some more traditional marketing efforts like television commercials and newspaper advertisements.

FUTURE DIRECTIONS FOR RESEARCH

What would be useful for future analysis is to ask more detailed questions about where people first heard about the project to better determine how many times they needed to be exposed to the project before volunteering to be involved.

A detailed cost-benefit analysis of all marketing initiatives would be useful. Also, a content analysis of print media would be useful to determine what type of photos or messages work most effectively.

Finally, it would be useful to correlate social survey data collected through this project to see if improvements could be made in the marketing message. Understanding barriers better will make it possible to design a more effective CBSM strategy. ❑



source:GCA EGH files

FIGURE 10 – EGH Evaluations by Ontario city, October 1999-January 2000

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Session C5

COMMUNITY-BASED COMMUNICATION STRATEGIES ON AIR ISSUES

Panel Discussion: Community-Based Communication Strategies on Air Issues

Chair:
Jennifer Yessis
Citizens' Advisory Committee on Air Quality (Waterloo Region)

Panel Members:
Brian Stocks
Air Quality Manager, Ontario Lung Association

Diane Szoller
London Air Quality Campaign

Heather Donison
Hamilton-Wentworth Green Venture, Green Communities Association, Hamilton Air Quality Improvement Committee

Chris Ford
Citizens' Advisory Committee on Air Quality (Waterloo Region)

Panel Discussion:
Community-Based Communication Strategies on Air Issues

Chair:
Jennifer Yessis

Panel Members:
Brian Stocks
Diane Szoller
Heather Donison
Chris Ford

ABSTRACT

Panel members will describe their community involvement, how their groups were first formed, strategies and actions that their groups take to communicate air issues, challenges that they face in communicating these issues and potential solutions to these challenges in an interactive question and answer session. Some questions that may be asked of panel members:

- *How did your air quality initiatives get started?*
- *What are your best strategies for communicating to the general public?*
- *How do you encourage action that may not directly benefit your local community?*
- *How do you address issues that may have provincial or federal jurisdiction locally?*
- *Are rural communities involved and how?*
- *How do these air issues relate to climate change?* ❑

Session P 2

PLENARY SESSION 2

Communicating the Science of Climate Change: A Mutual Challenge for Scientists and Educators
Gordon McBean
Environment Canada

Importance of, and Obstacles to Communicating Science to Policy- and Decision-Makers: Climate Science in Retrospect
Anthony Socci
Coordination Office of the US Global Change Research Program

Communicating the Science of Climate Change: A Mutual Challenge for Scientists and Educators

Gordon McBean

ABSTRACT

Despite a broad consensus amongst scientific experts that climate change is a serious issue needing the attention of policy communities and the public now, there is considerable public confusion about the related science, and a general apathy about the issue. The confusion about the science can be attributed to a combination of factors, including ineffective communication skills of the scientists involved, misinformation presented by contrarians and the failure of media to distinguish between scientific debate about detail versus significance. Educators and scientists must work together more effectively to address these barriers through improved access to comprehensible and quality information, and to foster a learning environment of critical thinking amongst students studying climate change. ❑

Importance of, and Obstacles to Communicating Science to Policy- and Decision-Makers: Climate Science in Retrospect

Anthony Socci

In the last two decades alone, the U.S. and large portions of the world have witnessed what can be aptly be described as an explosion of scientific information and technological innovations that has permeated almost every aspect of our lives. Given these trends, it is clear that science and the understanding of science are becoming increasingly more relevant and essential to decision-makers and the decision-making process. Every environmental issue confronting society has an undisputed scientific underpinning. Understanding the implications of the science underpinning issues of particular importance to the health and well being of society constitutes the basis for making more informed and enlightened decisions. However obvious this linkage may be, many factors continue to serve as impediments to the broader understanding and incorporation of science into policy- and decision-making processes, as perhaps is best exemplified by the case of climate science.

INTRODUCTION

In the last two decades alone, the U.S. and large portions of the world have witnessed what can be aptly be described as an explosion of scientific information and technological innovations that has permeated almost every aspect of our lives. Given these trends, it is clear that science and the understanding of science are becoming increasingly more relevant and essential to decision-makers and the decision-making process. Every environmental issue confronting society has an undisputed scientific underpinning. Understanding the implications of the science underpinning issues of particular importance to the health and well being of society constitutes the basis for making more informed and enlightened decisions.

However obvious this linkage may be, many factors continue to serve as impediments to the broader understanding and incorporation of science into policy- and decision-making processes, as perhaps is best exemplified by the case of climate science.

FACTORS IMPEDING THE BROADER INCORPORATION OF SCIENCE INTO THE DECISION-MAKING PROCESS

Frequent inaccuracies and distortions of science in television and news print media due to a fundamental lack of understanding of science and the methodology of science on the part of media. In addition, there is a preoccupation on the part of the media to portray climate science as "controversial", driven in part by an institutional emphasis on ratings, entertaining, garnering additional readership or viewership, and attracting operating capital through advertising. Accurate or not, "controversy" and "debate" entertain and sell. Media is a business.

Unwillingness or indifference on the part of the climate science community to communicate science clearly and effectively to decision-makers and other non-scientists. In addition, from an institutional perspective, there are no rewards for communicating science more effectively, nor is there any required or suggested training in communication as part of one's science curriculum.

The science community's reliance on statistical methods and criteria for expressing confidence, (certainty) or lack of confidence, is a major source of confusion outside of scientific circles. Such approaches to determining and expressing uncertainty are essentially foreign and highly confusing to most decision-makers and the public.

General lack of understanding of and appreciation for the so-called "scientific method", or the methodology by which science is routinely conducted.

Politicization of climate science on the part of some policy-makers and decision-makers, often driven by ideology and/or by virtue of vested interests in the potential social, policy, or economic implications (often perceived as negative) of the science.

RECOMMENDATIONS

- The media, policy-makers and other decision-makers should strive to become better acquainted with the "scientific method" and its implications.
- The media should refrain from engaging in the practice of selling "controversy" and "debate" as substitutes for responsible and accurate scientific journalism and reporting. Responsible media have an obligation to dig below the surface and determine if indeed there is a controversy in the first place. It is not enough to merely state or report that controversy exists.
- Members of the media should consider acquiring some scientific training. Institutional mechanisms and rewards need to be put in place in order to provide incentives for individuals to enhance their understanding of science and to foster more responsible and accurate science journalism. Alternatively, major media outlets might consider having science advisors or experts on staff.
- The media and the research community should cooperate to identify and experiment with novel approaches to working with and better understanding each other's culture.
- The science community (academic and otherwise) should create institutional mechanisms and incentives for facilitating improved communication of science to decision-makers and the general public. Institutional mechanisms and incentives could be in the form of: I) Requiring course work in communication and/or science journalism as part of one's scientific training; II) Removal of institutional disincentives to enhanced communication of science, such as not jeopardizing one's tenure by having devoted a certain amount of time and effort to the communication of science to non-science audiences. Perhaps in such cases one's tenure review period could be extended; and III) Earmarking some institutional research funds (in the form of competitive grants) to be made available to senior scientists, for example, who wish to explore ways to more effectively communicate socially relevant aspects of their science to policy- and other decision-makers.
- The science community and the policy community are urged to explore new approaches to being responsive to the needs of society and the needs of decision-makers. Perhaps venues modeled after the IPCC, that serve to bring forth the prevailing expert scientific wisdom should be explored, should be explored.
- Scientists might exercise some discretion in working with the media. Work with media people who are building or have built a reputation for responsible and credible reporting of science. Negotiate for the right to approve any news item or story for scientific accuracy and substance, before the article or story goes to press.
- Educating the public, the media, and decision-makers on the substance and importance of the "scientific method" will foster improved communication of science and the building of trust.
- Do not engage in self-deception. Improved communication of science will have little or no impact upon those whose positions on issues such as global warming are entrenched for ideological reasons or reasons born out of self-interests.
- Policy-making bodies such as the U.S. Congress should refrain from reducing science to political theater and from creating a hostile political environment for the communication of credible science by recognized experts. The temptation to "shoot the messenger" may be great but it serves no practical purpose.
- The expert science community must be left alone to determine who its experts are and what its expert judgement is at any one time. Policy-makers and others should not attempt to subvert this process.
- Decision-makers must be made to understand that the science community can strive to reduce uncertainty

surrounding complex issues such as global warming, but it cannot eliminate uncertainty entirely. The fact is, society routinely elects to take risks that carry an array of uncertain outcomes. Why should science be held to an unattainable standard?

- Policy-makers should not be dismayed at the fact that the science community is constantly revising its view of the world, but should instead look upon the "scientific method" as insurance that decision-makers will always have at their disposal, the most up-to-date scientific information at the time. Like all knowledge, scientific knowledge and information are constantly being re-assessed and revised through the "scientific process".
- When communicating with policy- and other decision-makers the science community might consider the following:

It's Not Academic - Refrain from making use of an academic presentation in a policy- or decision-making setting.

Remove the Jargon. - Adopt a common language devoid of specialized terminology. Relate to your audience.

Customize Your Presentation - A scientific presentation before a policy audience, for example, requires an investment of time and energy in crafting one's presentation for this specific audience.

Engage in a Conversation - Think of one's presentation as a brief conversation with a legislator.

Get to the Point - What is it that's important to relay to your audience? Present these key points, messages (punchlines) or conclusions right up front, and again at the end.

Do Not Engage in Prescribing Policy - A thoughtful and carefully crafted presentation, pitched at the appropriate level, will greatly facilitate bringing forth the policy implications and social relevance of one's research.

Adopt a Simple, Qualitative Method of Expressing Confidence or Certainty, or the Lack of It - The vast majority of policy-makers, decision-makers, and the public, do not understand, nor do they express, confidence in "scientific" terms. Making use of a rigid, statistically based procedure for determining and expressing confidence has little or no counterpart in the realm of policy, business, and the day-to-day lives of most people.

"Debate" is a Politically Loaded Word - A scientific debate in non-scientific circles is unlikely to be a clash of intellects and perspectives where reason prevails. Invitations to engage in a "scientific debate" are often invitations to engage in political theater surrounded by seasoned actors. ❑

Session D1

GREENSPIRATIONAL ODYSSEY

Greenspirational Stories of Effective Environmental Activism
Angela Bischoff and Tooker Gomberg
Greenspirations

Greenspirational Stories of Effective Environmental Activism

Angela Bischoff and Tooker Gomberg

ABSTRACT

It doesn't take much to be overwhelmed by environmental horror stories. It's tempting to give up hope. But changing the world can be a blast. It's all the more achievable if you have some basic activist skills, and lots of chutpah.

Angela Bischoff and Tooker Gomberg are longtime urban eco-activists. With slide images of their own eco-escapades from around the world and a dash of humour, they'll explore how to create worthy media events on a shoestring budget, and how to 'get the word out'.

After years in the trenches with non-governmental organizations, Gomberg spent a term on Edmonton City Council as a green Councillor while Angela rallied the troops from the outside. In 1996 they hit the road with their bicycles travelling the world in search of inspiring green stories. Their dispatches from the road have been widely published in print and on the internet (www.greenspiration.org).

You'll leave this workshop ready and anxious to take climate change "to the streets". ❑

Session D2

CLIMATE CHANGE EDUCATION THROUGH SCIENCE FICTION

Narratives as an Educational Tool: A Review of *A Scientific Romance*
Jenny Hughes and Jean Andrey
Department of Geography, University of Waterloo

Depictions of Global Environmental Change in Science Fiction: An Overview of Educational Applications
Lisa Kadonaga
University of British Columbia

***"A Scientific Romance"* - Reading and Reflection**
Ronald Wright
Science Writer/Author

Narratives as an Educational Tool: A Review of *A Scientific Romance*

Jenny Hughes and Jean Andrey

This paper explores narratives as a tool for educating the general public on climate change. It provides a qualitative evaluation of the adult-fiction narrative, A Scientific Romance, *written by Ronald Wright (1997). The novel is reviewed using criteria from both cognitive psychology and climatology. Wright's tightly crafted narrative successfully takes an abstract issue and transforms it into something interesting, imaginable, and relevant. It provides a detailed depiction of a plausible future climate and its implications for society. Unfortunately, no prototypes were activated with regard to the role of human action/inaction in triggering climate change and/or contributing to its consequences.*

NARRATIVES, COGNITIVE THEORY AND EDUCATION

> "The ambulances were streaking down the highway while I lay in bed in our farmhouse, in what used to be a very small town called Prairie Junction ... I wondered if a building was burning down, if there was a car accident at the perilous intersection, or a baby coming early in one of the subdivisions. Our range of disaster in that town was fairly limited, but we were due for something, certainly. The last rain had come at the beginning of April and now, at the first of June, all but the hardiest mosquitoes had left their paper skins in the grass. It was already seven o'clock in the morning, long past time to close the windows and doors, trap what was left of the night air, slightly cooler only by virtue of the dark. The dust on the gravel had just enough energy to drift a short distance and then collapse on the flower beds. The sun had a white cast, as if shade and shadow, any flicker of nuance, has been burned out by its own fierce center ... I often had the fanciful thought that the pond would save us; it would be the one thing that would postpone our deaths by scorching as the climate in our part of the world changed" (Hamilton 1994, 4).

The above quotation comes from a recent novel, entitled *A Map of the World*, by Jane Hamilton. Increasingly, climate change is being woven into fictional writings, such as this. However, it is exceedingly rare for climate change to be the central theme as it is in the novel, *A Scientific Romance* written by Ronald Wright. This paper explores Wright's narrative as a tool for educating the general public on climate change.

The power of the narrative—the story—is that it fits with how people make sense of their world. In the 1999 CBC Massey lectures, *The Triumph of the Narrative*, Robert Fulford describes storytelling as "the core of civilized life, the juncture where facts and feelings meet, the bundle in which we wrap truth, hope and dread ... it is how we explain, how we teach, how we entertain ourselves—and how we often do all three at once" (Fulford, 1999, back cover).

Cognitive theory argues that human beings think, perceive, imagine, understand and make choices according to narrative structures; that they create mental models or maps of where things are, how things work, how to act, who they are (Bardwell 1991). These maps "direct and constrain our thoughts, decisions and actions" (Kearney 1994, 426) in that we tend to notice and rely on information that reinforces or builds on these personal maps. In other words, knowledge is constructed, not received. This blueprint for human processes of learning and understanding reveals the attractiveness of using narratives, both fiction and non-fiction, as educational tools.

Despite the widespread use of narratives in everyday life, their integration into formal education or communication programs is biased toward selected subjects in the humanities and social sciences. From a disciplinary perspective, narratives are most established in the traditional teaching of history (Pomata 1989; Farmer 1990), where the value of narrative lies mainly in its vicarious nature and its connected presentation of the general flow of events in history. Modern history has largely abandoned the narrative in academic discourse (Rice 1995), but narratives in the form of fictional novels, wartime diaries and textbook inserts continue to be featured in history curriculum at all levels. The discipline of psychology also makes significant use of the narrative approach, where novels and biographies are used to "to vivify theories, which students often find too abstract, as well as humanize the stark quantitative findings of psychological research (Boyatzis,1992, 221). In most other disciplines, however, the use of narratives is much more restricted.

Outside of the academy, narratives in the form of parables and anecdotes have long been applied—both in oral and written form—in the realm of moral teachings. Indeed, many would argue that narrative material is central and essential to the effective teaching of morality because the narrative not only conveys information but also provides a mode of expression that produces meaning (Sandlos 1998; Fulford 1999).

Environmental education has two, sometimes disparate, goals. The first is to develop an understanding of natural systems, and the second is to encourage responsible action. Indeed, Sandlos (1998, 6) and others (Bardwell 1991; Monroe and Kaplan 1998) see the narrative approach as a means to provide a basis for environmental educators and students alike to "understand the 'story' of the ecological crisis as a moral dilemma, as opposed to a purely decontextualized instrumented problem". Despite its potential value, the narrative approach has had limited use in environmental education. This is true both generally and in specific reference to climate change.

Climate has long been recognized as an integral part of setting, and various novels develop both plot and character in the context of harsh or variable climate; stories from the Dust Bowl era provide some of the best adult illustrations, but there are also some examples in children's literature (e.g., Barrett and Barrett 1978). However, only now are we beginning to seriously consider the use of narratives as a strategy for communicating about climate change. One of the first scientists to illustrate the value of narrative in this context was Schneider (1989) in his *book Global Warming: Are We Entering the Greenhouse Century?*. The decision to use narratives in the Third Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) is perhaps evidence that the narrative is becoming an accepted form of expression in discourse on climate change.

RESEARCH OVERVIEW

Background on *A Scientific Romance*

This paper summarizes the results of an evaluative study of one novel that develops climate change as a central theme in the development of plot. The novel, *A Scientific Romance*, written by Ontario-based writer, Ronald Wright, was first published by Alfred A. Knopf Canada in 1997. The novel, which took three years to complete, has received rave reviews from literary critics in Canada, Great Britain and the United States (Abley 1997; Botsford Fraser 1997; Bromrose 1997; Weller 1998). It is a national best-seller in Canada and won the David Higham Prize for fiction from the United Kingdom.

It is difficult to provide a brief synopsis of the novel, but essentially *A Scientific Romance* follows the main character, David Lambert, into the future via H.G. Wells' own time machine in search of a cure for a degenerative disease from which he suffers. Lambert arrives in Great Britain, the year 2500, to find a luxuriant, but menacing new environment, which has been altered by the effects of climate change and is no longer inhabited by humans. The reader follows Lambert north in search of a surviving civilization, while Lambert explores the remnants of the land and the ruins of his own life history.

As an entry into the novel, it is worth considering the author's perspective—his thoughts and motivations for writing this book. In January 1999, when we first contacted Wright by email, he responded, "I wrote the book for the very reason that you suggest—to use narrative to try to change the world (which it hardly ever does) or, less vainly, to rail against the mess we're in". Later during an interview in Wright's home, he indicated that he always envisioned *A Scientific Romance* as a book with a message; as part of a tradition of books—a 'dystopia' that falls in with such novels as Orwell's *1984*, Huxley's *Brave New World* and Atwood's *The Handmaid's Tale*. These dystopias describe imaginary worlds, which are actually satirical caricatures of our own world. They take us into the future; and as Wright states: "Nobody thinks generations ahead—except through the imagination; that's where fiction comes in."

The idea for this novel came from Wright's background in archaeology as well as his interest and studies of ancient civilizations. The novel was born out of Wright's concern about civilization running out of control and growing to such as scale that the natural systems of the earth are no longer going to be able to sustain us without a great deal of degradation in the human quality of life. As Wright states, he tried to create a story that exposed "the sense of fragility of any civilization—poised on the knife edge of disaster and success."

Evaluation Criteria

The evaluation has two parts. The first is a critical commentary on the novel, based on criteria taken from Kearney's 1994 article entitled, "Understanding global change: a cognitive perspective on communicating through stories", published in the journal, *Climate Change*. Based on literature in cognitive psychology and education, Kearney identified five literary criteria that are essential for effective communication on such issues as global climate change : (1) It must be interesting; (2) It must present abstract information in such a way that the reader can imagine it; (3) It must relate to the reader's existing knowledge; (4) It must present global issues at a human scale; and (5) It must be extendible to provide a large experiential base.

The second part of the evaluation compares Wright's depiction of future climate with scientific projections. The comparison is necessarily qualitative, and it focuses on the Great London-Thames Estuary region of Southern England because Wright provides the greatest detail regarding climatic conditions at this locale. The climatic variables used in the evaluation consist of surface temperature, sea level rise, precipitation amounts and wind speed. Past climatic data were obtained from the World Meteorological Organization's climatological normals (1961-1990). These data were used to construct a contemporary climatology for the study area. Data on future climate scenarios were obtained from the CCCma's first-generation coupled general circulation model (GCM), CGCMI. The values used are from the GHG+A data set for the period 2071-2100. Because this model does not provide data beyond 2100 and does not offer any projections on sea-level rise, other climate sources were used as well. Goodess and Palutikof (1997) have performed extensive research with regard to projecting the climate for the British Isles beyond the 21st century. As well, scenarios generated by coupled GCMs developed by the Intergovernmental Panel on Climate Change (IPCC) (1996) provided information on sea-level rise.

EVALUATION OF *A SCIENTIFIC ROMANCE* BASED ON LITERARY CRITERIA

Criterion 1: It must be interesting.

Kearney (1994, 427) argues that "in order to maximize learning from a text, the reader must first attend to the text (perception) and then, while reading, integrate the information in the text with existing knowledge (knowledge integration)." Kearney suggests that an interesting text, which draws on involuntary (spontaneous and effortless) attention has the ability to accomplish both of these tasks. The first element used to create interest and promote understanding is content. Within the novel *A Scientific Romance*, Wright has woven a tale that integrates elements of time travel, a complicated romance, a deadly disease, the discovery of a startling 'new' civilization—all against the backdrop of a Great Britain that has been ravaged by the effects of global warming. Themes such as love, death, betrayal, exploration, discovery, and loss hold the reader's attention, while revealing details on the devastating impacts of climate change on the landscapes and peoples of southern England.

The second characteristic of a text that creates interest is coherence. "The memorability of a story depends on causal cohesion among events ... an incoherent text is unlikely to hold one's interest for long" (Kearney 1994, 432). In *A Scientific Romance*, coherence is created by a clear sense of movement through time—from David Lambert's initial discovery of the time machine, his journey into the future, his explorations of the London area, his expedition northward to the Scottish highlands, his discovery of a remnant civilization, and culminating in a daring escape back to the machine. The valued endpoint toward which Wright propels David and the reader is the quest to find a cure for the degenerative Creutzfeldt-Jakob disease that he has contracted and that has already claimed the life of his beloved Anita. Coherence is also created by the details that allow the reader to gradually piece together the puzzle of David Lambert's life history.

The third characteristic of text that instills interest is the presence of mystery or uncertainty, which causes the reader to generate a set of expectations. Wright continually forces the reader to anticipate events: Will the time machine work? Is England still inhabited and by who? Will David escape his captors? As the reader is lured further and further into the plot, s/he is involuntarily integrating information on the consequences of climate change into his/her cognitive models of human-environment interdependencies.

The final element that creates interest is vivid detail. *A Scientific Romance* is rich with description. As an example, the following quotation paints a picture of the London Estuary as discovered by David Lambert when he emerges from the time machine:

> Thick vegetation along the shore hides all other landmarks ... The water high and on the ebb, muttered and gurgled between candelabra roots; mosquitoes mobbed me; the knobbly knees of mangroves nudges me away. Beards of seaweed, the boasts of spring tides, hang from branches higher than my head. (78)

Criterion 2: It must present information in such a way that the reader can imagine it.
"Much of the information about global climate change is in the form of scientific data—abstract facts and figures that often have little impact on an individual's understanding of the issue" (Kearney 1994, 433). Kearney (1994) argues that information must be presented in such a way that the reader can imagine it, and this means that descriptions must be concrete and vivid.

Wright's depiction of the London area in 2500 arouses the senses, and the images that are created tackle complex issues. One such issue is ecosystem migration: "The tropical vegetation is a puzzle. How did it get here—as seeds in the stomachs of migration birds? Or did it tiptoe north, root by root, as the planet warmed?" (99). Other themes are regional variations in consequences: "I've been wondering again whether things could be better anywhere else." (176); high-order impacts, such as war: "What I found was this: a group of skeletons, human, muddled together. I exposed five individuals, all adults, four male, all with shackles of rust around wrists and ankles. Prisoners, obviously. Hostages, maybe." (118); the rapid rate of global temperature change: "Cycles have changed from ice to heat or vice versa not in millennia, but in decades" (88); and links between environment and economy: "Could it have gone another way? Is the Good Samaritan always a bad economist? Was capitalism—that "machine for demolishing limits"—a suicide machine?" (168).

Criterion 3: It must relate to the reader's existing knowledge
In order to construct new knowledge, information must activate existing prototypes and be incorporated into pre-existing cognitive maps. "Information about global change must speak to the beliefs that people already hold about the environment; it must also relate to their daily experiences and address perceived obstacles to behavior change" (Kearney 1994, 433).

Two aspects of the novel are particularly valuable for conveying a sense of the magnitude of the destructive potential of climate change. The first is setting. Since, much of the book's readership would be familiar with present-day London, Wright is able to build on these pre-existing images by describing water levels in reference to current landmarks or the remains of notable towers and castles. Analogies are also made between the fall of the ancient civilizations and the collapse of the modern world (88, 97).

Wright does assign blame for climate change, but many of the references are vague, for example: "their inventions, their beliefs, their ruthlessness—become indulgences that in the end will poison them" (66). There are a few references to fossil fuels as the principal anthropogenic source of greenhouse gases: "a sudden bonfire of the planet's coal and oil and timber can hardly have been a good idea" (88), but generally this theme is not well developed. Nor is the discussion on missed opportunities to reduce fossil fuel usage and energy waste, although there is one reference to electric cars (185). Furthermore, some of the references may add to public confusion about the causes of climate change versus other environmental issues, such as acid rain (e.g., "the sulphurous atmospheres of coal-fired London", 62) and the ozone hole (e.g., "Perhaps beyond this park the air conditioners are humming and the planet's envelope is still an awning gone to holes", 81).

Criterion 4: It must present global issues at a human scale.

Kearney (1994, 432) summarizes that for the average person "information about large scale events can be overwhelming" and for that reason an effective narrative must present global issues at a human scale. In *A Scientific Romance*, Wright shrinks a global catastrophe down to the level of an individual by telling the story through the eyes and experiences of a single character with whom the reader can identify. This use of a first-person narrative voice invites the reader on a shared journey with David Lambert.

There are, however, still elements of the narrative that may overwhelm the reader. The reader is not presented with any clues as to what can be done at a local scale to reduce one's vulnerability. And the radical alteration of the British Isles' environment at a time so far in the future may actually instill a state of disbelief, fear or helplessness.

Criterion 5: It must be extendible.

Kearney (1994, 433) concludes that "one interesting and useful text is a good start, but in most cases it will not be enough ... The prototypes that make up a cognitive map are built up slowly through repeated experience". Repeated exposure to a concept or idea through a variety of media enables individuals to construct, refine and/or strengthen their own mental maps. Therefore, an effective narrative must be extendible in that the story can be easily linked to other material that explores related themes.

A Scientific Romance is an excellent example of an extendible and expandable educational tool. Wright's text is a visual feast that introduces the reader to possible consequences of global climate change. The novel provides the general public with an accessible entry point into an unfamiliar domain by depicting how a familiar place may be changed. The novel introduces both direct and indirect impacts of climate change—from warmer temperatures and sea level rise to the migration of vegetative zones and the eventual disintegration of modern civilization. These images can be built upon as the individual encounters additional materials on climate change.

EVALUATION OF *A SCIENTIFIC ROMANCE* BASED ON SCIENCE

At present, the British Isles are associated with frequent rains and moderate temperatures. In the early part of the novel, before the time travel occurs, Wright's few references to weather are consistent with this image, e.g., his depiction of News Years' eve,1999: "Steady drizzle had fallen all afternoon. Mist flocked over the Thames in the evening chill and nibbled at the rooftops of the West End." (26). Most of the novel, however, takes place in the years 2500-2501, when Wright's depiction of British climate is considerably changed.

Temperature

Because of its maritime location, Britain currently experiences more equable temperatures than other places at the same latitude. In the London area, mean summer temperatures are 10.5 degrees C and 20.9 degrees C, for the minimum and maximum, respectively. The corresponding values for winter are 0.7 and 7.2.

With regard to scientific projections of future climates, all models indicate a gradual warming of Great Britain. Table 1 highlights the extent of warming that is projected for the Greater London area up to the year 2100. Model outputs were not available beyond 2100, but scientists envision three possible scenarios:
"The simplest assumption that can be made is of a relatively brief (say 1000 years) period of global warming followed by a return to the 'natural pattern' of glacial-interglacial cycles. The second possibility is that following

a longer period of global warming (up to 10,000 years) the next glaciation will be delayed and will be less severe. The third possibility is the irreversible greenhouse effect" (Goodess and Palutikof, 1997, 347).

The second scenario is considered most likely to occur, and scientists anticipate that Great Britain will experience 1000 to 10,000 years of subtropical or Mediterranean conditions (Goodess and Palutikof 1997).

Wright's narrative depiction of London's future climate is clearly more extreme than what scientists project. The climate of southern England is portrayed as tropical, as illustrated in many descriptive passages: "the foxheat of a rainforest" (77),"a tropical isle" (81), and "the jungle that is England" (151). At one point, Lambert remarks, "If it's this hot now [December], it must be hell in July" (82). During the months of December and January, the mornings are cool and mild (96, 119, 239). However, the temperature rises throughout the morning producing an intense midday heat (95, 96, 106, 130,143, 147). The scenario produced by Wright appears more consistent with the irreversible or runaway greenhouse effect than with scientists' 'best guess'.

TABLE 1
Mean Surface Temperatures for Greater London (degrees Celsius)

	WMO Normals 1961-1990	CCCma's GCM Projection for 2071-2100
Average maximum surface temperature - June	19.6	21.0
Average minimum surface temperature - June	9.3	15.9
Average maximum surface temperature - December	7.7	11.4
Average minimum surface temperature - December	1.3	7.6

Sea Level

Much of southern England is vulnerable to any increase in sea level, and an extensive system of sea walls currently protects some 700,000 ha of agricultural, industrial and residential land (Parry and Duncan 1995). Most of the land adjacent to the River Thames is less than 10 metes above sea level (Ordinance Survey 1981). Furthermore, high-tide sea levels in central London have been rising as a result of several factors: "global sea level rise; post glacier subsidence of the south-east of England; local subsidence, possibly due to water abstraction and clay shrinkage; and local river dynamics" (United Kingdom DoE, 1991, 50). Current rates of subsidence in south-eastern England range from –1 mm/year to –1.9 mm/year (Parry and Duncan 1995). Extrapolating these values to 2500 yield estimates of –75 cm subsidence. Changes due to subsidence will be exacerbated by sea level rise due to thermal expansion of the oceans and increased melting of mountain glaciers and the Greenland ice sheet. A 'best guess' global sea level rise projection for 2100 is 48 to 50 cm. Beyond that, sea level would continue to rise, "at only a slowly declining rate, for many centuries after greenhouse gas concentrations have stabilized" (IPCC 1995, 50). Together then, subsidence and sea level rise, are expected to result in increased water levels of several metres by the year 2500. Three of the IPCC's (1995) scenarios indicate sea level rise of +1.5m to +3m by 2500.

Wright's depictions of future sea level appear more or less consistent with this: "It's harder to confirm my exact position, for it appears that sea-level has risen several metres, drowning Canvey Island except for this small rise on which the pub once stood ... and widening the Thames Estuary by a mile or so" (77-78). Closer to London, Wright describes a landscape where sea level rise has obliterated the river's artificial banks; many of the industrial buildings and structures that once lined the river have crumbled and decayed; swampland can be found as far north as King George's Reservoir (137-8); and road and rail bridges than span the lower Lea are mostly underwater (137). In summary, Wright depicts a futuristic River Thames that has undergone dramatic, but still plausible, changes.

Precipitation

WMO climate normals for the period 1961-1990 indicate that the Greater London region receives an average of 754 mm of precipitation per year; virtually all of it falls as rain as there are typically only three to six snow days per year. Winter (October through January) is the wettest and dreariest season, with measurable rainfall nearly every other day and the average duration of sunshine only 50 hours per month.

With regard to future projections of precipitation, scientists emphasize the difficulty of predicting regional phenomena. However, researchers concur that winter precipitation in the Greater London – Thames Estuary region is likely to increase, while summer precipitation amounts are likely to remain unchanged (Parry and Duncan 1995; Raper et al. 1997).

It is difficult to determine from Wright's novel the exact amount and seasonal pattern of precipitation, but his depictions are consistent with projections of more and heavier winter rainfalls (79, 109, 137, 143, 162, 166, 187). In addition, the setting Wright creates for London in the winter of 2500 is an extremely lush and heavily vegetated environment, again suggesting the presence of abundant winter precipitation.

Wind

In present-day southern England, wind speeds are highest in the winter and lowest in summer. In all seasons, wind speeds are greatest in coastal areas (Barrow and Hulme 1997). Researchers project that global warming will be associated with an increase in the frequency of strong winds. The CCCma GCM projects December and January wind speeds of 4.8 m/s and 5.3 m/s, respectively, for the years 2071-2100, as compared to the current normals of 4.1 and 4.4. Unfortunately, little else can be said about future wind regimes because, at the regional scale, the uncertainty in climate modeling is still quite large (United Kingdom DoE 1991).

A Scientific Romance provides only a few insights into wind conditions: "the morning breeze still cool" (81), "a headwind creasing the open water" (96), "a gentle soak without wind" (105), "on these new waters ... the wind calm" (130), and "a breeze chased tatters of fog into the treetops" (140). Only once does the narrator find the strength of the wind notably strong: "A bothersome headwind fought me all afternoon, sweeping down the grassy floodplain that was once King George's Reservoir" (138). However, there is also one reference to a storm or tornado that downed trees (154). Wright appears to be more interested in the literary effects of the use of wind in his narrative and not so much with the accurate depiction of wind conditions for the years 2500-2501. However, one must also consider that most of Lambert's time in London was spent exploring inland waterways. At one point, Lambert climbs to the top of the Canary Wharf building and once above the dense vegetation cover, he notes that "the wind is alarmingly strong up here, sucking and blowing in sudden squalls—the tower yaws and shivers like the mast of a tall ship" (110).

CONCLUSION AND DISCUSSION

Narratives are a powerful communication strategy that have been underutilized in environmental education, generally, and in communications on global climate change, more specifically. This paper provides a two-part qualitative evaluation of one adult-fiction narrative, *A Scientific Romance*, written by Ronald Wright (1997). The novel was reviewed using criteria from both cognitive psychology and climatology. We conclude that Wright's tightly crafted narrative successfully takes an abstract issue and transforms it into something interesting, imaginable, personal and relevant to the reader's existing knowledge. It provides a detailed depiction of a plausible future climate and its implications for society. However, we feel that it has two minor weaknesses as an educational tool. First, there is little direct reference to the principal causes of climate change; indeed, references to sulfur emissions and ozone depletion may re-enforce public confusion over different environmental issues. Second, the climate scenario depicted in the novel is more consistent with the runaway greenhouse theory than with scientists' best guess of what future climates will be. The magnitude of the portrayed change may create a sense of disbelief or helplessness.

In closing, we would like to say that despite the inherent appeal of the narrative as a communication strategy, stories can be dangerous (Cronon 1992; Fulford 1999). Different story tellers will have varying agendas, such that facts and details will be carefully selected and pruned as the plot is developed. In its most extreme case, the ancient rule passed down through generations of cynical journalists will hold true: "Never let the facts get in the way of a good story" (Fulford 1999,18). Thus, as with any powerful tool, it is important to use narratives carefully and responsibly. ❑

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Depictions of Global Environmental Change in Science Fiction: An Overview of Educational Applications

Lisa Kadonaga

Science fiction books and movies reach a wide audience, including people not currently in school, and those who avoid educational programming. Although most SF depictions of global environmental change are outdated and oversimplified, the genre could raise public awareness and encourage discussion of ecological and social impacts. SF writers have considered both natural systems and human societies, anticipating the work of impacts researchers. Both science fiction and global change require knowledge and creativity to construct realistic extrapolations. However, well-written SF may reach a larger cross-section of the public, while emphasizing that climate projections are principally intended as warnings, not prophecies.

INTRODUCTION

In November 1998, 63% of Canadian adults surveyed felt it was likely that global warming would "make more of the world unliveable" by 2050 (Chisholm 1998). Various researchers, including several other contributors to these conference proceedings, have investigated where people obtain information for making these kinds of assessments about climatic change. To date, most attention has focused on the educational system, and on the news media. However, prior to the 1980s, the theories behind atmospheric change were rarely encountered outside of physics and earth science courses. Unless people elected to take these subjects during their degrees, they would have graduated without covering the concepts.sions of environmental problems.

Although information on environmental change has become widely available through the print and electronic media, opinion is divided on the effectiveness and accuracy of these types of sources. While Hare (1998) felt that the increased quality and quantity of reporting have contributed to better public understanding of phenomena like El Nino, Dworkin and Pijawka (1982) noted that media attention can also contribute to inaccurate impressions of environmental problems.

A third possible way in which people's impressions of climatic change are shaped is through works of fiction, including novels, short stories, films, and television. These sources reach a wide audience, including people not attending school, and those less inclined towards popular science literature or educational programming. Gowda et al. (1997) found that nearly 35% of American high school students sampled claimed that TV was their major source of information, a figure higher than print media and school curricula combined. Nielsen Media Research (1999) indicated that for the 18-49 demographic, the most popular syndicated shows included *Star Trek DS9, Earth: Final Conflict*, and *The X-Files*. No science-based programming made it onto the list.

Since the early 1990s, references to global environmental change have become more common in movies and TV, particularly in science fiction and fantasy. The popularity of these genres among high school and college students implies that the impressions conveyed onscreen could be either reinforcing or refuting things they have learned in the classroom.

Science fiction has received its share of criticism. Almost every movie or TV series that purports to be science fiction seems designed to mislead viewers about science: explosions are audible in space, and telepathy is as accepted as computers. British SF author Brian Earnshaw (1983) blames his colleagues for making too much of spaceships and extraterrestrials, arguing that this type of escapism distracts us from doing anything about problems here on Earth. Yet there is also a strong opposing belief that science fiction can encourage citizen action. Judith Merril (1994) argued: "It's the only place you can do any useful thinking about the idea that there might not be a future" (16). Since its beginnings early in the 20th century, the genre has been credited with raising public awareness about issues like eugenics and nuclear weapons. Even global change researchers have recognized the possibilities of SF. Kearney (1994) notes that stories about realistic characters and their problems, are "particularly compatible with the way people process information; it is one way to effectively communicate information about global change" (420).

CLIMATIC CHANGE AND SCIENCE FICTION

Asserting that science fiction writers do not consider the facts is analogous to stating that all scientists are lacking in imagination. The people who are the best in either of these fields are able to combine careful and meticulous research with creativity. Climate change impact scenarios are essentially science fiction, based on the "what if" of a doubling in atmospheric carbon dioxide. The "hard" variant of SF claims a close relationship with the sciences: in this tradition, accuracy is highly prized, and errors are frequently attacked by critical readers. According to Hartwell (1994), "The world of the hard sf story is deterministic, ruled by scientific law: It is inimical to anyone who does not know said law or how to figure it out" (34). Benford (1994) describes "giving scientific misinformation to the reader" as "the unpardonable sin", because "the authors want to retain the authority of nonfiction" (18).

Both global change researchers and hard SF writers must use reasonable assumptions to work forward from basic scientific principles. Scientists, too, have sometimes chosen to present their results in storytelling form (e.g. Carson 1962) in order to reach a wide audience of non-specialists.

Storytelling formats are particularly appropriate for global change concepts, for at least two major reasons. First, global change involves factors that are beyond everyday human experience, in terms of spatial and temporal scale, and the complexity of the impacts. " [Carbon dioxide and ozone] can't be smelled or seen and people generally don't perceive their impact as being as direct or significant as that of a nuclear blast or rising interest rates" (Kearney 1994, 424).

Second, the level of uncertainty attached to climate change projections is high, and the pace of research is rapid, unfolding in many directions simultaneously. Theories are set up, then appear to be debunked and discarded a few months later. Behind the scenes, researchers may have spent several years testing their models, and making modifications: the public rarely sees this side, and instead may suspect that scientists can't make up their minds. Exacerbating this is the tendency of some media commentators to present global warming scenarios as virtual certainties, seldom explaining the methods used to arrive at these forecasts, or the sources of error involved. Global warming researchers take a different approach: scenarios are viewed only as starting points. From this perspective, the point of predictions is not to sit back and wait for them to come true, but to give us some advance warning of the range of possible impacts that could occur.

An early example of such an educational scenario, dealing with alternative energy futures, is Sewell and Foster (1976), which was laid out in the form of a fictional parliamentary debate occurring on May 14, 2000. A later book by Foster (1997), using a similar format, encourages readers to think about the strategies which enable societies to deal with "the stresses created by change" (3).

Fiction has an important advantage in these situations: people are much less likely to take accept it uncritically, yet still can consider the ramifications. Just as George Orwell's novel *1984* became a watchword against totalitarian control, readers tend to interpret stories as warnings rather than hard-and-fast predictions. In the case of global warming, where there is so much uncertainty, this may be more valuable than purely quantitative scenarios.

Changing climates have been featured in science fiction literature for decades (e.g. Clarke 1966). Generally, writers have favoured catastrophic scenarios, typical of the "disaster story" or "post-apocalyptic" subgenres. While these depictions are frequently at odds with current trends in environmental change, there are some areas of agreement with scientific findings.

Direction of change

While some hard SF authors appear to have understood the theory behind the greenhouse effect (e.g. Hogan 1977), this information wasn't always applied to forecasting possible futures. Prior to the 1990s, stories about a new ice age seemed to dominate. Interestingly, this coincides with colder conditions earlier in the century (Gullett and Skinner 1992). Silverberg (1980) recalled: "The winter of 1962-63 was a notably snowy one in New York [...] All that snow was very much on my mind in the spring of 1963 when I proposed doing a science fiction novel [...] of the next ice age" (vi-vii).

Ice age stories were still being published in the 1990s (Reeves-Stevens 1992, Moran 1995), after global warming gained media prominence. Part of this may have been due to delays in writing and publication. In terms of literary connotations, cold is almost always equated with loneliness, alienation, and hostility (Carter and Carter 1989). Reeves-Stevens (1992) used the advancing glaciers as a metaphor for emotional distance: "the ice that's ploughing down from the north in unending sheets that soon will defeat the summer for ten thousand years is my soul" (312). In contrast, words such as "warm" and "hot" have both positive and negative associations, so their symbolism is more ambiguous.

There might also be historical reasons: the Little Ice Age only ended in the late 19th century, so colder conditions may seem more familiar. Many Canadians can recount tales of winter hardships experienced by their ancestors in the years before the First World War. Intervals significantly warmer than today, such as the Medieval Optimum, may be too distant in space and time for most people to feel a connection.

Speed of Change

Many fictional descriptions of climate change have assumed a relatively rapid onset, presenting a variant of the classic disaster story. One example from television is the *Star Trek: The Next Generation* episode "A Matter of Time". The Enterprise visits a planet where "an asteroid impact has caused a dramatic drop in temperature" (Lynch 1995), and the crew decides to "trigger a greenhouse effect by drilling down to pockets of carbon dioxide in the crust of the planet". The audience may be left with a confused impression of global climate change, since the story supposedly unfolds within a few days.

Ongoing change is much less common in SF than the catastrophic disaster story or the post-apocalyptic epic. In one example, McCullough (1985) portrays a society transformed by a new ice age. The direction of the temperature shift is different from that predicted by current theories, but it remains one of the most intricate novels ever to incorporate climate change. Sudden and long-term change are not necessarily exclusive: Sterling's *Heavy Weather* (1994) contains elements of both viewpoints.

Forcing Mechanisms

There appears to have been a transition in the climate forcing mechanisms selected by SF writers. In earlier decades, changes in climate were independent of human activities: fluctuations in solar output or the earth's orbit, interstellar dust clouds, volcanic eruptions, and other natural phenomena. More recently, there has been a tendency to assume that changes are anthropogenic, brought about through warfare or pollution. This coincides with the rise of the environmental and peace movements of the late 20th century, and growing publicity about global warming.

A growing number of SF writers view low technology as viable and even preferable, particularly if it is backed up by scientific understanding (LeGuin 1985, Hughes 1992). A whole branch of environmental science fiction, noted by Elbow and Martinson (1980), has continued to develop the issues of coping with change and simplified lifestyles (Robinson 1990).

> She knew that in the world of the future, there wouldn't be cars [....] There would be no private houses with lawns or pleasure vehicles. There would be only small groups of people dependent on one another for survival. There would be hard and constant work for food in a sick and plundered nature. (Schulman 1994, 45)

> There's not a lot us country folk can do about the ozone layer and the greenhouse effect that we haven't already done or been forced to do by circumstance. We've had to give up cattle and chemical fertilizers. We burn as little wood as we can and rely on wind and solar power for our needs. (Hughes 1992, 175)

Types of Impacts

Some SF authors realized early on that changes in average temperature and precipitation values are difficult to relate to everyday human experience. Potential environmental and social impacts are far more compelling:

> The water encroaches on all coasts. Weather patterns change. The Great Lakes become desert. Food prices rocket up. Winter becomes more hesitant, with plants trying to grow in February. Annual migrations are confused and freak storms appear: thunder in January, blizzards in May. Some species – polar bears, moose, salmon – are wiped out. Others – cockroaches, rats, sea gulls – propagate wildly. This was the unbalanced, wounded world Beryl expected in the future; this was the world she thought she'd been made for. (Schulman 1994, 34)

In addition, people can identify more easily with extreme values, and specific events: how high will the temperatures go, the onset of spring rains, and the presence of snow at Christmas (Woo 1992, Rebetez 1995).

> Summer swelled up [...] more ephemeral in these days when people were perpetually aware of its brevity [...] but no less hot [....] The only real difference [...] was its duration, shorter now by about four weeks. (McCullough 1985, 156)

> It was only June, and already people were dying [....] it wasn't yet the kind of heavy weather where the feds would start sending in the iron-barred evacuation trucks [....] But it was the kind of heat that kicked up the stress several notches. So the old folks' pacemakers failed, and there'd be gunfire in the evening and a riot at the mall. (Sterling 1994, 201)

Sea level rise is one of the most popular concepts taken up by fiction writers:

> The ice that melts from both poles as a result of the greenhouse effect will fill the oceans, raise the waters. Beryl lived in Boston, a harbor town. When she walked along the streets, she imagined the tops of the trees swaying gently with the water [...] (Schulman 1994, 34).

> Their thoughts are like their country now, constrained by dykes that will never withstand the thousand-year patience of the sea. (Reeves-Stevens 1994, 310).

Robinson (1981) describes the mixed feelings of a former resident of Venice, about the foreign visitors who are plundering historic art treasures from the now-inundated churches. In the 1995 movie *Waterworld*, the co-opting of the Universal Studios globe at the beginning was perhaps the most entertaining part of the film: instead of cutting to the title credits, the camera zooms in as the land areas on the globe are gradually overwhelmed by the ocean. *AI*, scheduled for release in 2001, is said to take place in "a flooded futuristic world" (Rose 2000), where cities have been inundated. The technical challenges and visual impact of "a submerged Manhattan, its skyscrapers rising totemically from the tidal stew" (Parisi 1997) are likely irresistable to many filmmakers.

Sometimes SF has even anticipated scientific findings:

> Pat had flung her teen-age years at the burning forests of northern Ontario [....] The fires had become more and more frequent as the greenhouse effect worsened [...] there was no going back, and the forests could not be saved as long as the climate continued to get hotter. (Trudel 1994, 105).

At the time Trudel's story was originally written, research into the impacts of climate warming on boreal ecosystems was still in its early stages (Sargent 1988, Wheaton and Singh 1989, Franklin 1990). Most speculation was focused on the agricultural sector, and at the time, many Canadians anticipated a milder climate. Later research suggested that fire, disease, and species replacement could create significant disturbance in the northern forests (Cohen 1997), if not the catastrophe depicted by Trudel.

The long-term work by Stirling et al. (1999), predicting serious consequences for polar bear populations, was widely reported in the press. Schulman used preliminary reports to speculate on what the disappearance of sea ice might do to the Arctic ecosystem:

> Beryl knew that in the future world of small things, the polar bear probably would not exist. The greenhouse effect will warm the North Pole by up to nine degrees. The ice that the bears live on during the winter won't form until later in the year and will melt earlier, depositing the bears one by one into a bay a thousand miles wide. (Schulman 1994, 33)

The possible effects of global warming on human society are more nebulous. Some SF writers have chosen to explore these issues, which are also being investigated by social scientists involved in global change research. Perhaps the clearest depiction of government policies specifically intended to cope with climatic change, and the reaction to them, appears in McCullough's new ice age novel (1985). Her fictional future American government restricts most aspects of everyday life. Although she assumes a remarkable degree of compliance, she does provide examples where people disobey the law:

> [....] people who remained in Connecticut all year round, and suffered the cold dumbly, and didn't quite understand all the reasons why the government was so adamantly against wood burning [...] now felt an unaccustomed stirring of old, buried emotions. (62-64)

Sterling (1994) imagines the fate of the High Plains inhabitants who attempt to remain on the land, in defiance of government regulations: perhaps incorporating the rise of anti-government sentiment observed in the 1990s.

> They just couldn't stand it [...] that we hadn't cleared out for good and gone exactly where the government said we should, when we should. That we didn't pay taxes, or get vaccinations, or have any rule books [....] They broke us up, and they shot us and arrested us, and they put us away in camps. (141)

McCullough points out that shooting is not necessary. There are other ways to close down a community:

> Those who insisted upon remaining in the doomed cities [...] after winter relocation was phased out altogether (the estimate given for this was another ten years) would not be forcibly removed [....] Simply, they would receive no aid, no tax benefits and no welfare. (158)

Environmental refugees are featured prominently in global warming SF: a graphic scene from the 1993 TV miniseries, *The Fire Next Time*, shows desperate Americans trying to cross the newly-fortified border into Canada. McCullough (1985) was among the few novelists to address the social and economic ramifications of permanently relocating large numbers of people:

> When relocation had begun over twenty years earlier, no one who still had a job in the north wanted

> permanent relocation; but that state of affairs was now reversed [...] a harassed government fell ever further behind in the number of permanent places it could offer potential relocatees [....] because property in the north and midwest was fetching next to nothing, there were many indeed who could not relocate permanently until they received official help [....] The warmest of the southern states fought desperate battles to curb the growth of trailer parks and shantytowns [...] (156-157)

Researchers are only beginning to investigate the psychosocial dimensions of global environmental change. Fiction authors have had an early start:

> Jeff was only sixteen, but he had that drawn, tight-around-the-eyelids look that Alex had seen on the faces of displaced people, of the world's heavy-weather refugees. A haunted, wary look, like the solid earth beneath their feet had become thin ice, never to be trusted again. (Sterling 1994, 133)

> Two months before relocation [....] in which to pack away things not wanted down south and wind up affairs and start the telephoning and queueing to see how and when the winter exodus would be conducted [....] people began to tell each other how glad they would be to quit the place, preferably for good. Who wanted or needed this circus living, forever packing up and moving on? (McCullough 1985, 157-158)

Scientific literacy and climate change

Concern has been raised about apparent gaps in public understanding of the causes and potential impacts of climatic change (Nelson et al. 1992, Bostrom et al. 1994, Boyes and Stanisstreet 1994, Read et al. 1994, McDaniels et al. 1996, Gowda et al. 1997, and others). Confusion between stratospheric ozone depletion and the greenhouse effect persists even among university science graduates. This misconception seems to have made its way into popular culture: Kathy Bates's character in the 1990 film *Misery* attributes shorter winters to the ozone layer.

Both scientists and hard science fiction writers are concerned about a decline in the public's scientific knowledge: Benford (1994) laments that the "high-tech imagery" used by many films and television shows may be a shiny facade: "In a nation of declining science-related skills, written hard sf may reach a shrinking audience" (15). Regarding global warming, Read et al. (1994) fear that "...some of these misunderstandings could misdirect the public's support for proposed policies, as well as leave it vulnerable to manipulation by interest groups" (971).

It doesn't help that *The Arrival* (1996), one of the few big-budget Hollywood movies to mention global warming, also incorporates extraterrestrial invaders and shadowy government conspiracies. Fortunately, conditions are also becoming more favourable for more intelligent public debate. Scientific inaccuracies in books, films, and TV can be more widely discussed through the Internet: this "netpicking", often led by hard SF fans, may appear trivial at first, but can aid the development of critical thinking. A posting about *Waterworld*, on one movie discussion site, is representative of some of the more thoughtful commentary. Investigating whether this complaint is valid would be a relatively easy classroom exercise in basic physics and geology:

> The premise is impossible. So only 100 or so feet of Mount Everest is above water? That would mean the world was under 29,000 feet of water. From what I have heard, even if the ice caps melted completely (as they have in the distant past), only the coastlines would be under about 300 feet of water. Sure it would be a disaster, but going from 300-29,000 feet is ridiculous. (dgm59 2000)

CONCLUSIONS

Even though *Waterworld* was a critical and box-office flop, there are many reasons why the use of global warming scenarios in written or onscreen science fiction may not be entirely bad: and if handled carefully by science educators, could improve public awareness.

First, SF makes global change information more widely available to the public, especially young people. For example, paleontology has experienced a surge in popularity with the most recent wave of dinosaur movies.

Second, fictional scenarios may suggest new directions of research, and offer unexpected insights into potential impacts, which may have been overlooked or underestimated.

Third, collaboration between researchers and SF writers could produce some interesting work. *The Fire Next Time* is one of the few SF films which examines global warming in any detail: climatologist Stephen Schneider provided consultation. There may be an opportunity for interested groups to commission original works, as has been done for other topics such as bioethics. The study by Gowda et al. (1997) suggested that global change researchers can play an important role in public education. When respondents were asked which group they trusted most to give accurate information about climate change, scientists received the top ranking — ahead of teachers, environmental groups, and the media.

Finally, in the long term, encouraging interest in global environmental change can help demystify how science works. Perhaps the most valuable function of climate projections is as a starting point for learning about how the environment works, and to get people talking. Presenting scenarios as ways to identify potential problems, rather than as prophecies set in stone, still conveys a warning while lessening the expectation of absolute accuracy. In his fictional example, Strong (2000) emphasized: "This is not a prediction [...] simply an attempt to portray the kind of world that would result from our continuing a 'business -as-usual' attitude" (A11). Above all else, the global warming debate is in need of thoughtful, balanced presentations: this is possible in fiction as well as in non-fiction, with the advantage of being accessible to a wider cross-section of the public. ❑

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"A Scientific Romance" - Reading and Reflection

Ronald Wright

ABSTRACT

The novel, A Scientific Romance, *is a dystopia, a chronicle of love, time and destruction. The story follows the main character, David Lambert, into the future via H.G. Wells' own time machine in search of a cure for a degenerative disease from which he suffers. Lambert arrives in Great Britain, the year 2500, to find a luxuriant, but menacing new environment, which has been altered by the effects of climate change and is no longer inhabited by humans. The reader follows Lambert north in search of a surviving civilization, while Lambert explores the remains of the land and the ruins of his own history.*

In this presentation, the author, Ronald Wright, will do a reading from A Scientific Romance *and share a reflection on his reasons for writing this book.* ❑

Session D4

NATIONAL AND REGIONAL COMMUNICATION STRATEGIES 3

Sustainability in Sovereignty
Carlton James
Caribbean Planning for Adaptation to Climate Change

Facilitating Stakeholder-Led Assessment of Climate Change Impacts: the UK Climate Impacts Programme (UKCIP)
Merylyn McKenzie Hedger, Megan Gawith, Iain Brown and Richenda Connell
UK Climate Impacts Programme

Climate Change Risk Communication: A Stakeholder-Based Approach
J. Spyres,[1] K. Sibold,[1] B. Binns[2] and N. Davis[2]
1. U.S. Environmental Protection Agency
2. ICF Consulting, Washington, DC

Communication and Engagement: A Review of Strategies from the Great Lakes-St. Lawrence Basin Project
Linda Mortsch
Environment Canada

Sustainability in Sovereignty

Carlton James

Sea-level rise and other extreme climatic events pose a serious threat to the Caribbean; especially, but not exclusively, the smaller island developing states (SIDS). In a premptive move, 12 countries, sovereign states, Antigua and Barbuda, Bahamas, Barbados, Belize, Dominica, Grenada, Guyana, St. Kitts & Nevis, St. Lucia, St. Vincent and Grenadines, and Trinidad and Tobago, are collaborating in a four-year project Initiated by the Caribbean Community of which they are all members. Financial and Technical support is provided by The Global Environment Facility (GEF) . The Project, Caribbean Planning for Adaptation to Climate Change (CPACC), known as see-pack, runs from 1997 to 2001, and has received positive evaluation is its mid-term review conducted in September 1999. Its key areas of focus are:

- *Vulnerability Assessment*
- *Adaptation Planning and*
- *Capacity Building linked to adaptation planning*

CPACC collaborates closely with the University of the West Indies Centre for Environment and Development and is coordinated by the Secretariat of the Caribbean Community (CARICOM). Its eight components are

- *Design and Establishment of Sea-level/Climate monitoring*
- *Establishment of data-bases and systems*
- *Inventory of coastal Resources and use*
- *Formulation of a Policy Framework for Integrated Coastal and Marine Management.*
- *Coral reef Monitoring for Climate Change*
- *Coastal Vulnerability and Risk Assessment*
- *Economic Valuation of Coastal and Marine Resources*
- *Formulation of Economic and Regulatory Proposals*

Against this background, CPACC has developed a Public Awareness and Information Dissemination (PAID) Strategy to address the primary challenges as follows:

1. *Convincing policy-makers, the private sector and a wide variety of publics including media and NGO's in participating countries that global climate change does pose a threat to them.*
2. *Designing and implementing a strategy to address the needs of participating countries with varying legal, regulatory and judicial processes, and in varying stages of planning for adaptation to climate change.*
3. *Supporting the strengthening of public awareness capacities, primarily among National Implementation and Coordination Units (NICUs) in participating countries.*
4. *Maintaining communication flow with and within the network of CPACC stakeholders*
5. *Establishing active strategic partnerships with the international Distance Education Community, e.g. The Commonwealth of Learning; The University of The West Indies (UWI) Distance Education Centre.*
6. *Developing a CPACC agenda for the region's Youth movements*
7. *Insinuating climate change issues into the regional educational system as a dimension of existing curricula.*

INTRODUCTION

Twelve countries in the English Speaking Caribbean, all former British colonies that gained independence between 1962 and 1980, are now sovereign states. These twelve sovereign states are Antigua and Barbuda, Bahamas, Barbados, Belize, Dominica, Grenada, Guyana, Jamaica, St.Kitts & Nevis, St. Lucia, St. Vincent and Grenadines, and Trinidad and Tobago.

Their populations range from over 2 million in Jamaica and Trinidad and Tobago, to 45,000 in St. Kitts and Nevis, and 70,000 in Antigua and Barbuda. They manage their own economies. Each is a member of The Caribbean Community, the United Nations System, the Organization of American States, and other regional and international economic groupings like The Commonwealth, and the African Caribbean, and Pacific States group in association with the European Community.

Tourism and Agriculture are their main sources of employment and foreign exchange earnings. Coastal areas are especially at risk: They hold the vast majority of population and economic activity vital to their prosperity, and are a vital economic resource in that they also support a wealth of living marine resources and high biological diversity.

There are some variations, however. In the case of Trinidad and Tobago, Petroleum is the major foreign earner and it continues to discover copious quantities of natural gas as new fields are discovered. Jamaica and Guyana produ[illegible]xite; and Barbados, petroleum and natural gas enough for national consumption.

Antigua and Barbuda

The Bahamas

Barbados

Belize

Dominica

Grenada

Guyana

St.Lucia

Jamaica

CPACC PARTICIPATING COUNTRIES

St. Vincent & the Grenadines

St. Kitts and Nevis

Trinidad and Tobago

Commonality

Sovereignty and political independence notwithstanding, these states face a common challenge; the threat of global climate change and with it, sea level rise and other extreme climatic events. The threat is serious; especially but not exclusively, for the smaller island developing states (SIDS); Antigua and Barbuda, Barbados, Belize, Dominica, Grenada, St.Kitts & Nevis, St. Lucia, and St. Vincent and Grenadines. The coast of Guyana, one of the larger countries, (216,000 ha), is some six feet below sea level, and yet is the base for its main foreign exchange earner, Sugar, exported primarily to Europe.

CPACC

The threat posed by global warming comes at a time when already, the Caribbean Community region is under stress. Many things contribute to this; increased human activity, tourism-related infrastructure, poor disposal of liquid and solid waste, decaying draining infrastructure, uncontrolled development schemes, severe weather events, mismanagement of coastal ecosystems, and build-up of silt due to poor watershed management.

In a preemptive move, coordinated by the Caribbean Community of which they are all members, the governments of these states have responded to the common threat by collaborating in a four-year project, The ***"Caribbean Planning for Adaptation to Global Climate Change*** (CPACC), Pronounced ***see-pack***, the project aims to enable the management of these countries to adapt lifestyles and planning styles and to mitigate the anticipated effects of the anticipated effects of climate change.

CPACC helps these countries to assess how vulnerable they are to the effects of Climate Change; to plan to adapt their styles of physical development and infrastructure; to train their people to address these issues, and to be part of a regional network of countries addressing this common challenge. The major threat and concern to these countries is anticipated global warming, consequent rise in sea level, increase in sea-surface temperature, changes in wind and ocean currents, and the impact of these events on coastal areas. For most, the entire country is a coastal area.

CPACC runs from 1997 to 2001. Funded by the Global Environment Facility (GEF), managed by the World Bank and executed by the Organization of American States. It will assist national governments and the University of the West Indies Centre for Environment and Development (UWICED) to:

1. Strengthen the regional capability for monitoring and analyzing climate and sea-level dynamics and trends, seeking to determine the immediate and potential impacts of GCC
2. Identify areas particularly vulnerable to the adverse effects of climate change and sea-level rise
3. Develop an integrated management and planning framework for cost-effective response and adaptation to the impacts of GCC on coastal and marine areas
4. enhance national and regional capabilities for preparing for the advent of GCC through institutional strengthening and human resource development; and
5. identify and assess policy options and instruments that may help initiate the implementation of a long-term program of adaptation to GCC in vulnerable coastal areas.

Its main areas of focus are:
- Vulnerability Assessment
- Adaptation Planning and
- Capacity Building linked to adaptation planning

Its nine components are
- Component 1: Design and Establishment of Sea Level/Climate Monitoring Network
- Component 2: Establishment of Data Bases and monitoring Systems

- Component 3: Inventory of Coastal Resources and Use
- Component 4: Formulation of a Policy Framework for Integrated and Marine Management
- Component 5: Coral Reef Monitoring for Climate Change
- Component 6: Coastal Vulnerability and Risk Assessment
- Component 7: Economic Valuation of Coastal and Marine Resources
- Component 8: Formulation of Economic and Regulatory Proposals
- Component 9: Greenhouse Gases Inventory/ Agriculture and Water Resources Vulnerability Assessment

CPACC collaborates closely with the University of the West Indies Centre for Environment and Development and is coordinated by the Secretariat of the Caribbean Community (CARICOM). Its nerve centre is the Regional Project Implementation Unit (RPIU) based in Barbados.

Gradually, but perceptively, CPACC is being transformed from merely a project into an alliance between the national and regional Private Sectors, the Media, service organizations and civil society in general. CPACC has received positive evaluation in its mid-term review conducted by the World Bank in October 1999, as well as in the report of the World Bank Supervisory Mission, 28-31 March 2000.

Communicating Climate Change

The World Bank mid-term review of the CPACC Project, October 1999, identified as an urgent requirement the need for a major effort to raise public awareness and promote public education on Climate Change issues in the Caribbean. Specifically it saw the need for:

1. the development of an information kit for decision-makers containing materials on CPACC and climate change issues to support national and regional participation in the COP process.
2. a plan for maintenance and broad dissemination of the CPACC web-site, www.cpacc.org to provide linkages to all of the data collected by CPACC (tidal gauges, coral reef monitoring) as it becomes available, as well as to key national and international climate change web-sites and information sources.
3. the development of a media campaign on CPACC and other climate change activities
4. the design of a public education campaign, which would include the development of curricula, materials and other initiatives, aimed at clearly demonstrating the social and economic benefits to be derived from the project.

Against this background, CPACC developed a Public Awareness and Information Dissemination (PAID) Strategy to encourage support and participation in CPACC and action at national level among CPACC participating countries, their nationals, organizations and agencies. The PAID strategy addresses the primary challenges of:

1. Convincing policy-makers and publics in participating countries that global climate change does pose a threat to them, and that they are agents of influence and catalysts for action in the adaptation process.
2. Designing and implementing a strategy to address the needs of participating countries with varying legal, regulatory and judicial processes, and in varying stages of planning for adaptation to climate change.
3. Supporting the strengthening of public awareness capacities, primarily among National Implementation and Co-ordination Units (NICUs) in participating countries.
4. Maintaining communication flow with and within the network of CPACC stakeholders
5. Establishing active strategic partnerships with the international Distance Education Community, e.g. The Commonwealth of Learning; the University of the West Indies (UWI) Distance Education Centre.
6. Developing a CPACC agenda for the region's Youth movements

Specific target groups/stakeholders include:

- government ministries and departments

- The Private Sectors
- The average citizen of the Caribbean and its Diaspora, primarily in North America
- The donor community
- Universities and research institutions
- Youth organisations
- women's groups
- indigenous peoples organisations, and
- Civil society in general,

The PAID Strategy: Overall Objective(s)

To encourage support and participation in CPACC and action at national level among CPACC Participating Countries, their nationals, organisations and agencies, These include

- government ministries and departments
- The Private Sectors
- The average citizen of the Caribbean and its Diaspora, primarily in North America
- The donor community
- Universities and research institutions
- Youth organisations
- women's groups
- indigenous peoples organisations, and
- Civil society in general,

The PAID Strategy: Specific Objective(s)

- To elevate Climate Change to the Regional Political Agenda, where it becomes a national and regional planning issue rather than a matter assigned to sectoral ministries.
- To build- capacity in the development and management of PAID activities at the national and regional levels and in the Secretariat of the RPIU.

ANTICIPATED IMPACT

The CPACC Communication Strategy is designed to have a positive impact on Planning and action in the Caribbean countries. Through the implementation of the Strategy, policy-makers are being encouraged to take a number of positions/actions:

Salt water intrusion

Develop policies to increase the efficiency of water distribution and use; commission engineering and structural improvements to water supply infrastructure; develop water quality programmes in conjunction with Ministries of Health; and encourage storage of water as part of domestic disaster preparedness.

Public Health

Develop comprehensive health care policies; Strengthen emergence response systems; facilitate the use of water purification systems; develop and implement clean air policies and monitoring programmes

Climate Change Predictions (general)

Reduce CO2 emissions despite the low level emitted from the region when measured against that of the industrialized North; reduce dumping into oceans; and preserve beached and natural defences

Risk Management

Develop public awareness and education programmes; appropriate maintenance legislation, resettlement policies; integrated land use planning; adopt the coastal zone management framework; enforce legislation to control sand mining; collaborate with the insurance and development finance sector; and establish and enforce building codes and standards.

Coral Reefs

Reduce destruction of mangroves and wetlands; reduce marine pollution and agricultural and land-based runoff; and protect reefs.

Agriculture

Reduce intensive fertilizer use and animal grazing in coastal zones to avoid soil degradation; reduce deforestation; allow land to recover through crop rotation

Tourism

Enforce beach protection and eco-tourism policies, develop initiatives to diversify the tourism industry; reduce and discourage development on the immediate coastline, in the process enforcing setback policies; and value coastal and marine resources.

In summary, as a result of CPACC and complementary initiatives, planners and the management of countries in the Caribbean are expected to thing and act in a more informed way. The success of the CPACC Project is dependent upon public awareness, participation, and ownership. Indicators of impact would include:

- an improvement in levels of understanding of issues and implications of climate change among peoples of the Caribbean.
- a perception of CPACC as a positive initiative in the region
- the opening of new channels of feedback as regards CPACC proposals and activities.
- an increase in levels of support and participation for CPACC, and its institutional successor, the Regional Climate Change Centre, among Caribbean Nationals, the Diaspora, and the wider stakeholder groups.

Anticipated Impact

The CPACC Communication Strategy is designed to have a positive impact on Planning, development and thinking in the Caribbean. The success of the CPACC Project is dependent upon adequate levels of public awareness, participation, and ownership. Indicators of impact would include;

- an improvement in levels of understanding of issues and implications of climate change among peoples of the Caribbean.
- a perception of CPACC as a positive initiative in the region
- the opening of new channels of feedback as regards CPACC proposals and activities.
- an increase in levels of support and participation for CPACC, and its institutional successor, the Regional Climate Change Centre, among Caribbean Nationals, the Diaspora, and the wider stakeholder groups.

The Communication or PAID Strategy has prioritized a number of recommendations to be pursued, as always, based on the availability of funds. These are:

- **Increased attention to high-level advocacy**
- **Building and consolidating strategic networks** at the political level (Heads of Government, Ministers of Foreign Affairs, Environment, Agriculture, Tourism etc.) and internationally, at the level of agencies and institutions dealing with environment, development, science and technology.

- **The co-opting of agents of influence to feature in public service announcements** on radio and television.
- **The setting-up of a Learning Resource Centre** at its Headquarters in Barbados and a sub-Centre at the Secretariat of the Organisation of Eastern Caribbean States (OECS) in St. Lucia.
- Production and dissemination documentaries, and news items for the regional media
- **Training of national focal points** (NFPs) in the preparation and presentation of material for radio.
- **Hosting and facilitation of a regional Media Consultation** on Climate Change **and** the work of CPACC in 2000, and a **Seminar for the Region's Private Sector.**
- Training of CPACC Technical and Professional Staff in media relations and advocacy.
- **Entering into co-production arrangements** with North American and European television entities on Climate Change issues.
- **Information exchange with Latin American projects and organisations**, possibly utilising the Organisation of American states, The Association of Caribbean States, and the United Nations Economic Commission for Latin America and the Caribbean (UN/ECLAC*)*, as main conduits.
- **Incorporating Distance Education technologies into its training of NICUs, and for public awareness and information dissemination.** The Distance Education Centre of the University of the West Indies (UWI) could serve as a node for teleconferencing among the CPACC stakeholders.
- **Infusing Climate Change issues into the curricula of schools in the region through the Caribbean Examinations Council (CXC).**

Implementation

The project prioritised the Media Consultation and the Seminar for the Region's Private Sector as meriting early implementation. Hence these were held in April and May 2000 respectively. A review of the two activities brought to the fore some encouraging aspects. For example:

1. The Media Consultation:
    - Set a record for number of media practitioners interacting with project personnel, officials and scientists on an environmental issue.
    - Produced a broad spectrum of participation. ***Media practitioners (Print and Electronic) came from; Antigua and Barbuda, Barbados, Dominica, Grenada, Guyana,*** **Jamaica,** ***St. Kitts and Nevis, St. Lucia, St. Vincent and Grenadines, and, Trinidad and Tobago. The participation of other Trinidad and Tobago (T&T) Ministries and Statutory bodies, e.g. the Government Information Service, the Planning Authority, and the Water and Sewerage Authority (WASA) was most welcome. These agencies are now part of the communication and public awareness network of the project. The Participation of international wire services, e.g. The Associated Press (AP) and the Caribbean News Agency (CANA) is a portent for sustainability of the Strategy and the efficient distribution of material via the media.***
    - **Created awareness.** *At start of activity on Day 1, most participants were unaware of CPACC. By Day 2, they expressed the view that the subject was important to the survival of the region and initiated the setting up of a CC Media Group. The group proposes the name Media for Climate Change Awareness (MECCA).*
    - **Provided Feedback.** *The participants called for CPACC to produce a user-friendly vocabulary to enable them to comprehend and follow the issues of climate change; for information on climate change in general and on project activities in particular. Information on political and legislative processes was specifically noted.*
    - **Acknowledged the need to strengthen national public awareness capacity in participating countries.** *Hence the participation of National Focal Points (NFPs) or representatives of National Implementing and Coordinating Units (NICUs)*

2. The Private-Sector Seminar. Here
    - **Political will was evident and strong.** *Dr. Reeza Mohammed, Trinidad and Tobago's Minister of Environment, attended sessions and call for a Permanent Committee of Ministers for Environment within the 15-member*

Caribbean Community. This will be presented to the administrative and political directorates of the Caribbean Community, which include the Conference of Heads of Government. Dr. Finbar Gangar, Trinidad and Tobago's Minister of Energy and Energy industries pledged cooperation of his Ministry and the Energy Industrial sector in the movement towards a clean development mechanism (CDM)

- **Strategic alliances were identified and initiated.** *The Private Sector committed to collaboration with regional scientists and planners to develop strategies to deal with the anticipated impacts of Climate Change, and to participate in adaptation and mitigation measures as appropriate. Commitment was made also to developing a networking strategy for the private sector on the issue. This would represent a formalized relationship between CPACC and the insurance, banking, agriculture, and tourism sectors.*

Sovereignty and Sanity

Fortunately, the matter of climate change and its anticipated impacts is one, which has been allowed to transcend sovereignty. What appears clear to policy-makers in the CPACC Participating Countries is that small island developing states are especially at risk and that the time-honoured environmental adage, "think global act local" is apt. Local in this case refers to the entire region in terms of impact, and to countries in terms of the legal and regulatory process required to address a common threat. In the case of the CPACC Participating Countries, sovereignty is not an obstacle to actions aimed at Sustainability.

CONCLUSION

Inevitably the question will be asked, "have we begun to experience the effects of global climate change?" This we must meet with more of a response than an answer.

- Historical data for the Caribbean Sea points to a relationship between a temperature increase of 1.5% C and increased hurricane frequency.
- Since 1860, the warmest years on record are all post-1990.
- Fish kills in Guyana, Grenada, St. Lucia, St. Vincent and Grenadines, Barbados, and Trinidad and Tobago in 1999, have been linked to excessive outflows of freshwater from the major South American Rivers, the Amazon and the Orinoco, and with it attendant bacteria, alien to marine species.
- Coral bleaching events. The most severe occurred in 1987.
- Increase on incidence of prolonged wet or dry seasons
- Changing rainfall patterns.
- Phenomena: For example, Hurricane Lenny in 1999 approached the Caribbean from the West, leaving destruction, and not a little surprise, in its wake, and affecting almost every country in the region in some way. Prior to that all hurricanes in memory approached from the East

As a project, CPACC comes to an end in December 2001. Discussions already underway appear to be leading to an implementation phase and the establishment of a Regional Climate Change Centre. Communication and advocacy remain crucial elements of the initiative and a crucial element of the Public awareness strategy will be training the core professionals of the project to recognize, initiate and generally take advantage of media and other types of advocacy opportunities. This could become a crucial component of their active work schedules. The ultimate and achievable goal is to have the Caribbean citizenry understand the implications of global climate change; treat it as a social, political, and economic development issue; and be ready to support the establishment and eventually maintenance of a Regional Climate Change Center. ❑

PROFILE OF COMMUNICATION CONSULTANT

Carlton A. W. James

Mr. Carlton James is a communication strategist and trainer with over 30 years national and international experience;

currently coordinating implementation of the Public Awareness Strategy of CPACC.

His environmental communication activities cover some 20 years and include assignments for 28 governments; the International Development Research Centre (IDRC) of Canada; the United nations Environment Programme; The Caribbean Conservation association, The International Plant Genetic Research Institute, The Commonwealth Secretariat, and the Organization of American States.

His non-environmental communication strategy assignments include work for the Secretariat of the Caribbean Community, US Agency for International Development (USAID), The Pan American Health Organization (PAHO/ WHO), UNESCO, UNICEF, The European Community and The UN Food and Agriculture Organization (FAO)

His consultancy and training services cover; public participation and consensus building; radio and television production and presentation; environmental public awareness; science and technology; distance education; poverty alleviation; HIV/AIDS education; human resource development; media liaison; corporate image analysis and management; gender parity in development, and democracy and good governance.

Facilitating Stakeholder-Led Assessment of Climate Change Impacts: the UK Climate Impacts Programme (UKCIP)

Merylyn McKenzie Hedger, Megan Gawith, Iain Brown and Richenda Connell

Communication is a central and complex part of the process of achieving integrated assessment in the UK Climate Impacts Programme (UKCIP). The Programme was established to engage stakeholders directly in assessing the impacts of climate change by enabling them to undertake research which served their needs for information for adaptation. The implicit aim has therefore been to work with partners rather than communicate to external parties. An explicit aim is that by providing an integrative framework within which studies are undertaken, individual sectors will obtain a more realistic assessment of climate change impacts. In order for this approach to work effectively a range of support tools and methods are being developed which are funded by central Government. Studies within the Programme are currently funded directly by consortia of stakeholders (local, regional and central government, non-governmental organisations such as conservation organisations, and business, including water companies). A key communication issue has been for the Programme Office to explain how impacts studies can be undertaken and why there are advantages in working collaboratively. Feedback from stakeholders is helping to develop tools and provide information for studies on potential impacts.

The paper explains the origins of the Programme as a strategic development by the Department of the Environment, Transport and the Regions. Over a dozen studies are now underway and four have been completed. Key points on communications issues are:

1. *Integrated assessment is intended to provide useful information for decision-making. From the UKCIP experience it can be seen that communication is a multi-faceted dimension of integrated assessment. In the Programme, there have been information flows in all directions. There is however clearly scope to improve the quality of these exchanges with visualisation tools, decision-support tools and so on.*
2. *Rapid appraisals have been produced which successfully reach decision-makers. There appears to be a need to balance the quality of science and the usefulness/ rapid production of the communication tool.*
3. *Stakeholder surveys within the Programme have scarcely yet probed the issue of what actually will trigger a change in policy-making priorities which will enable adaptation measures to get underway. As there is inherent uncertainty in the climate change issue, this means guidance must be provided as to how to handle uncertainty.*
4. *There is scope to exploit the great interest that exists at a local level to translate what the global issue of climate change means at different scales, by developing monitoring measures and indicators of climate change at a regional level.*

INTRODUCTION

Communication is a central and complex part of the process of achieving integrated assessment in the stakeholder-led UK Climate Impacts Programme (UKCIP). First it is vital to obtain initial involvement of organisations. At a second stage, effective communication improves the quality of the integrated assessment through a two way flow: information is provided to the users and researchers about the integrative framework; and, then consultees provide information for the studies through surveys and workshops. Finally there is dissemination of the results of the Programme, which encourages further engagement and so on. Through media coverage at this stage, the general public are also contacted. In addition, the smooth flow of information within the Programme, between users, between researchers and between users and researchers, is crucial to its effectiveness.

The Programme has been working with a wide range of organisations in the public and private sectors to engage them in modular studies of the impacts of climate change so that they can make informed decisions about adaptation options. The Programme provides a common framework for the undertaking of the studies so that they can be integrated to provide a national assessment which informs Government decisions on adaptation and mitigation policy. There is no central pool of funds: currently studies are funded by stakeholders, including organisations in the public sector.

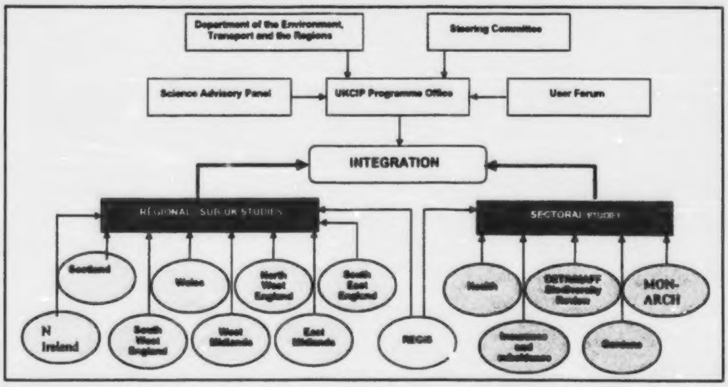
This paper is structured in the following way:
1. The origins and key features of the UKCIP are explained;
2. General programme communications are briefly reviewed;
3. Communication dimensions connected with the provision of tools for integrated assessment are outlined;
4. Key stakeholder communication issues are identified;
5. Discussion points are raised on communication and integrated assessment from the experience of the Programme.

1. KEY FEATURES OF UKCIP

The Programme is part of the ongoing research strategy on climate change of the Department of the Environment, Transport and the Regions (DETR), which has the lead within UK Government on the issue. To date the focus of Government policy has been mitigation through the reduction of greenhouse gas emissions. However, if concentrations of atmospheric CO_2 are stabilised at 550ppm (the level proposed by the EU to guide emissions reduction efforts) temperatures are still expected to rise by about 2°C compared to the present day. Thus, Government support for the Programme recognises that climate change impacts have to be tackled. Mitigation issues are separately addressed by Government and not intended to be covered by the Programme.

At the heart of UKCIP is a small Programme Office based in the Environmental Change Institute of the University of Oxford. The Programme is advised by a Steering Committee comprised of representatives of key Government departments, public agencies, the private sector and NGOs . A Science Advisory Panel oversees the integrity of the work. A User Panel is being activated to enable organisations seeking to work on climate change impacts to interact directly with the Programme. There are also now a number of steering committees for projects operating within the Programme (see Diagram 1).

Diagram 1. Structure of UKCIP


Department of the Environment, Transport and the Regions
Steering Committee
Science Advisory Panel
UKCIP Programme Office
User Forum
INTEGRATION
REGIONAL / SUB-UK STUDIES
SECTORAL STUDY
Scotland
Wales
North West England
South East England
N Ireland
South West England
West Midlands
East Midlands
REGIS
Health
DETR/MAFF Biodiversity Review
MON-ARCH

Critical aspects of the approach, structure and work of the Programme were determined through a scoping study, funded both by Global Atmosphere Division (GAD) of the DETR [2] with the Environment Agency which involved Canadian and US based scientists (in touch with the Mackenzie Basin Impacts Study). The scoping study recognised that successful integrated assessments should be: based on "sound science using the best available information"; and, "credible for policy makers through establishing an open process involving potential stakeholders to ensure the assessment addresses their needs" (SPA and ESYS, 1996 p.ii).

Aims for the new UK assessment were to:

- Provide information on climate change impacts to stakeholders for decision-making;
- Provide relevant outputs to stakeholders and connections to other sectors for integration;
- Act as a demonstration study.

Extensive stakeholder consultation and a two day workshop tested the emerging ideas. The moment seemed right to try a cross-cutting, integrated approach led by stakeholders to try new methods, following on from the second report of the UK Climate Change Impacts Review Group published in 1996. (This was a sectoral assessment by experts based on the HadCM1 climate model (CCIRG, 1996)). In April 1997 UKCIP was started, with the aim of producing an integrated national assessment of the impacts of climate change though stakeholder-led studies, to inform policy-making on adaptation and mitigation. Thus, the Programme was based on the rational utility model of decision-making, in that it was assumed that 'better' information would be used to make 'better' decisions.

From the early stakeholder consultation exercise it was anticipated that there would be a willingness to fund studies through the Programme. However, no clear working arrangements were suggested to operationalise this approach. The Programme currently has no direct funds of its own to undertake research, so it has been working largely in a "bottom-up" mode, supporting organisations - the "stakeholders" - to initiate studies which assess their own vulnerability and work out their responses. In the first three years, the Programme Office has focused its activities on getting studies underway so that there would be a body of modular studies which could then be used to produce an integrated assessment. However, it should also be noted that, arising from the initial scoping study, one specialist study (the REGIS project) has been funded, largely by central Government, to explore integrated assessment methodology. DETR has funded the development of core products to support studies and to facilitate integration. These are discussed further in Section 3.

In the emerging theory on Integrated Assessment, the UKCIP methodology can probably be classified as an "heuristic and exploratory method", such as expert judgement or policy exercises (Rotmans and Dowlatabadi, 1997 p.294). Studies have been undertaken as separate entities and the first phase sub-UK scoping studies have been undertaken mainly by literature review, use of expert judgement and contacts with key stakeholders. However, the concept of the common framework for studies, together with the tools so far adopted and being developed, does provide a coherent way to structure and present scientific knowledge of climate change, (particularly the process clarifying current uncertainties, climate change scenarios, socio-economic scenarios) which is the core concern of integrated assessment theorists.

2. GENERAL PROGRAMME COMMUNICATIONS

The various types of communication activities which have been undertaken in the Programme are: general awareness raising and promotion to obtain involvement of stakeholders, and thereafter maintaining networks; improving the quality of the integrated assessment; and disseminating the results of the programme, (which encourages further engagement and so on).

General communications activities contribute to achieving an integrated assessment by providing a common 'soft-management' of studies. The Programme Office provides advice before and during the commissioning of studies, monitors progress, helps to maintain momentum of projects, facilitates effective networking, and

disseminates information about the Programme, activities within the Programme and wider developments. General awareness raising and information provision has been achieved through:
- A regular newsletter and website;
- Technical reports (see below);
- Presentations to a wide range of audiences;
- Hosting events for specialist audiences.

These activities so far have used routine tools and methods and will therefore not be covered in any detail. Considerable information about the Programme has been disseminated by presentations to a range of events, by UKCIP and DETR staff. Over 200 events were covered in the initial three years including industry briefings and a Farmers Breakfast Club. Furthermore, in addition to the use of stakeholder surveys and workshops to obtain information for the studies within the Programme and to develop products, (see below), specialist events have been held, including a Research Forum.

As contacts within the Programme increase, its capacity to provide an informal networking facility grows exponentially. Connections are made between people engaged in specific projects and the UKCIP has also become a new link between users and researchers.

As indicated, studies are funded by 'stakeholders', unlike the US and Canadian National programs, so that the Programme Office has to advocate and encourage involvement by 'selling' its services and products. This is not to say that the Programme operates in a hostile or difficult environment. There is widespread acceptance in all sectors, including the business world that human-induced climate change is underway. Indeed finding new angles on that to engage bored newspaper editors is taxing environmental correspondents of national newspapers. Decentralisation measures to new devolved administrations in Scotland and Wales, coupled with measures to strengthen regional administration in England has provided structures whereby the widely perceived fascinating global issue of climate change can be translated into regional and local scales and thereby made accessible and relevant. So the Programme has been able to take advantage of this new energy and make good progress in the first three years. Studies within the Programme have been occurring at a level which was not anticipated, and year by year targets originally set for the Programme have been exceeded. At the same time, expectations for the Programme have increased, in view of the general perception that climate change is now the basis for action, rather than an event that will occur at some time in the future.

3. PROVISION OF TOOLS FOR INTEGRATED ASSESSMENT

To obtain consistency between the varying modular studies and to enable their integration, a common framework is provided and is being further developed by the Programme which is communicated principally by means of Technical Reports.

(i) Data-sets: The Programme provides access to key data-sets. The needs of each project for data are negotiated individually. Key data-sets are being compiled in a Geographical Information System (GIS) for use in UKCIP modular studies.

(ii) Climate Scenarios: A new set of climate change scenarios was commissioned for the Programme by the DETR from the University of East Anglia's Climatic Research Unit and the Hadley Centre. The report (Technical and Summary) on climate change scenarios, entitled *Climate Change Scenarios for the United Kingdom* (Hulme and Jenkins, 1998) was launched in October 1998. The scenarios have been used in all UKCIP studies to date and have proved to be a critical means of facilitating integration between studies.

(iii) Socio-economic scenarios: DETR commissioned the Science Policy Research Unit (SPRU) at the University of Sussex to develop a range of socio-economic scenarios to support UKCIP. The work builds on that of the IPCC's Third Assessment Report, and on the Futures scoping study by the UK Office of Science and Technology's

Foresight Panel. Experience gained with operationalising these scenarios will be incorporated in to a Technical Report which is being currently being prepared.

(iv) Risk and Uncertainty: UKCIP is working with the Environment Agency to develop a Technical Report that will provide guidance to decision-makers on dealing with risk and uncertainty in decision-making. The report will incorporate testing on case studies to illustrate the integrated use of the assessment tools and techniques. These case studies are being conducted in a number of topic areas including: water resources, the Thames Barrier, coastal and fluvial flooding and strategic forestry planning.

(v) A methodology has been commissioned for costing the potential impacts of climate change in the UK. The methodology is being developed for use by studies within the Programme and will be used initially to assess the costs of impacts on key sectors of the UK which are potentially sensitive to climate change, e.g. the coastal zone and water resources, for the 2020s and 2050s. The purpose of this project is to make a significant first step to assist future bottom-up, stakeholder-led work conducted within UKCIP, often by non-economists.

Experience with climate and socio-economic scenarios will be briefly reviewed here.

Climate Scenarios

The UKCIP98 climate scenarios have established a common factor by which results from different impacts studies can be integrated and different sectoral and regional trends deduced. The scenarios reports (both Summary and Technical versions) have proved to be an important communication tool and have given leadership for the Programme. The accessibly-written reports, which have been widely presented in workshops, have promoted increased awareness of the issue of climate change amongst stakeholders, by providing four quantitative estimates of the magnitude of climate change in the 2020s, 2050s and 2080s (low, medium low, medium high, high). They are all derived from the HadCM2. Guided sensitivity tests of the UKCIP scenarios have been conducted (in the REGIS study) to compare them with other GCMs and establish their robustness [3]. The UKCIP98 scenarios have now become the standard reference for climate change studies in the UK. Copies of 4000 Summary Reports and 750 Technical Reports have been distributed. A CD-Rom has also been made available. There has been considerable feedback from users about their needs, which is being used to frame the next scenarios. The UKCIP 2001 scenarios will provide more detail on extreme events and improved regional predictions of climate change by using the Hadley Centre Regional Model with a higher spatial resolution (50km). Daily data will be generated for some key variables, which will assist in the assessment of low frequency high magnitude impacts.

Socio-economic Scenarios

Production of socio-economic scenarios has proved to be challenging as this has been an innovative enterprise. The main effort of the initial research team developing the socio-economic scenarios focused on the national level (Berkhout *et al.*, 1999). Early feedback from stakeholders suggested that there were problems using national level scenarios at a sub-UK level. A workshop was held in February 2000 to consider operational experience gained from applying the scenarios in the early scoping studies. Results will enable guidance on the application of scenarios at a sub-UK level to be presented alongside the national scenarios in the final draft Technical Report. Key communications issues have been:

- The storyline approach is complex to explain to those who have not come into contact with it before and credibility issues are faced.
- Specific resources are needed within scoping studies to produce downscaled, regional versions of the socio-economic scenarios. Telephone interviews with stakeholders do not allow for exploration of complex alternative future worlds.
- Particular problems were faced in the sub-UK scoping studies with their limited access to baseline data at a regional level which can be manipulated to ally with future scenarios.
- The use of socio-economic scenarios brings into play critical social and economic factors which have not yet received full attention in studies.

4. STAKEHOLDER ENGAGEMENT AND AWARENESS ISSUES

UKCIP has engaged with "stakeholders" at two levels. One group has funded studies. A broader consultation group provided much of the key information about expected impacts and likely responses on which the scoping studies are based, particularly those at the sub-UK level. In addition the sectoral studies have used stakeholder workshops to develop products for individual project and policy recommendations. A full analysis of the stakeholder engagement activities within the Programme has not yet been completed. Main findings on information and associated issues are:

- Sectors vary considerably in their understanding of the climate change issue, so it has been difficult to assess expert responses consistently between sectors.
- Success of a particular interview was highly dependent on the knowledge of the stakeholder and the context of that sector.
- Respondents from sectors with short planning horizons had not considered longer-term changes, and therefore had difficulty conceptualising some future impacts.
- Studies varied considerably in the way interviews were conducted.

Stakeholder interviews in the first round of scoping studies produced insightful and useful results in a cost-effective way. Because of the complexity of communicating information about climate scenarios and socio-economic scenarios it has been found that the workshop approach offered benefits over interviews. However, in a relatively small place like the UK, key people have had to be involved in many workshops and some evidence of 'stakeholder fatigue' is evident.

In the sub-UK scoping studies, the UKCIP98 climate scenarios were considered vital for providing a 'vision of the future' for surveys of stakeholders, but in practice were only discussed superficially at interviews. An awareness of the general sensitivity of stakeholders to climate change was needed before their sector's vulnerability to specific impacts could be properly evaluated. A perceived problem is that stakeholders' views were often coloured by unscientific press reports rather than clear and objectively-based scenarios presented by the study team. The scoping studies varied in their quality and in the expertise available to review specific sectors. In order to help frame reactions on adaptation responses, interviewers occasionally discussed scenarios of impacts with stakeholders as if they were formal predictions with some confidence. Although this may not have been the intention, it is often implied by generalisations such as 'agriculture will suffer from reduced precipitation and increased evapotranspiration'. The result is a superficial 'common wisdom' about impacts becoming accepted as well-documented fact, and then as the basis for action (Brown *et al*, 2000). This may give the impression that further research is unnecessary since we already know what the impacts will be.

Several studies emphasised the need for improving stakeholders' knowledge of climate change and specific recommendations were made. Many decision-makers indicated that they would need to have a much clearer picture of what will happen before they change investment decisions. This issue is related to the fact that the planning timescales of climate change present problems for public as well as private sectors, and particularly do not match the 2-5 year spans of many businesses.

Key Points

1. Integrated assessment is intended to provide useful information for decision-making. From the UKCIP experience it can be seen that communication is a multi-faceted dimension of integrated assessment. In the Programme, there have been information flows in all directions: from developers of methodologies to contractors on studies and vice-versa, from decision-makers to researchers, from researchers to decision-makers, between decision-makers and between researchers. There is however clearly scope to improve the quality of these exchanges with visualisation tools, decision-support tools and so on.

5. Considerable momentum has been realised within the Programme around the first phase scoping studies at a

sub-UK level. Quite limited resources were available for these studies. Rapid appraisals were produced which successfully reached decision-makers. However, there were limits visible in the treatment of climate and socio-economic scenarios within these studies. Often, for example, only one of the four UKCIP98 climate scenarios was used for detailed analysis. There appears to be a need to balance the quality of science and the usefulness/ rapid production of the communication tool.

6. Stakeholder surveys within the Programme have scarcely yet probed the issue of what actually will trigger a change in policy-making priorities which will enable adaptation measures to get underway. Whilst there is a considerable body of literature on the broad topic of public understanding of climate change, and some work which examines the motivation of the individual to change aspects of his/her behaviour for the sake of the environment, there is very little yet known about what motivates decision-makers to factor in climate change when it is only one of the issues s/he faces. What has emerged from the Programme so far is that decision-makers want definite information before they will take action. As there is inherent uncertainty in the climate change issue, this means guidance must be provided as to how to handle uncertainty.

7. There is scope to exploit the great interest that exists at a local level to translate what the global issue of climate change means at different scales, by developing monitoring measures and indicators of climate change at a regional level.

8. To clarify for decision-makers that there are layers of uncertainty in impacts assessment, consideration is being given within the Programme to the development of an "impacts" scenario with high/ fast and low/slow changes. ❑

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FOOTNOTES

[1] Acknowledgement: The concept for the UKCIP was developed by David Warrilow and Penny Bramwell of DETR. The views expressed in this document are those of the authors and do not necessarily reflect the views of DETR.

[2] Then the Department of the Environment.

[3] The core scenarios have been found to occupy the mid-range when compared with the full range of extremes produced by the other GCMs

Climate Change Risk Communication: A Stakeholder-Based Approach

J. Spyres, K. Sibold, B. Binns, and N. Davis

Global climate change poses a multitude of risks to several vulnerable populations. The U.S. Environmental Protection Agency's (EPA's) Climate Outreach and Innovations Division developed an interactive risk communication effort designed to increase awareness of the risks of climate change so that these populations can make informed decisions about risk management strategies for addressing global warming or contribute to discussions about those strategies. The Division selected constituencies that are affected by climate change, –are capable of participating in mitigation and adaptation strategies, or can assist in communicating the risks of climate change to the public. The constituencies selected include the following six groups: meteorologists, coastal communities;, outdoor enthusiasts, public health professionals, businesses, and state and local government leaders.

OVERVIEW

History

The two programs that constitute the risk communication program include the Climate Information and Outreach Program and the State and Local Climate Change Program. The Climate Information and Outreach Program has endeavored, since its inception in April 1996, to communicate scientific information on the potential impacts of climate change to targeted constituencies. The purpose of this communication program is to facilitate effective risk management strategies to address this national and international concern and promote meaningful voluntary mitigation and adaptation strategies. The State and Local Climate Change Program, for the past nine years, has been helping states and communities understand the risks associated with climate change and identify opportunities to reduce emissions of greenhouse gases. This capacity-building program provides states and local governments with guidance, financial assistance, and technical information to help them prepare inventories of their greenhouse gas emissions, assess and build awareness of the impacts of climate change through a comprehensive outreach program, and develop action plans to reduce emissions. Integrating these two programs into one Division enabled us to leverage resources and coordinate our efforts in order to maximize outreach to the targeted constituencies.

Risk Communication Framework

Risk is the likelihood for harm to people, the environment, or other values from a particular hazard. Greenhouse gases, for example, may result in risks to human health, ecosystems, and the nation's economy. The purpose of risk communication is to enhance understanding of the hazards, to clarify choices that involve risks, and to encourage dialogue between constituencies and decisionmakers. Participants in risk communication invariably include groups that have different priorities or values. Effective risk communication is an interactive and iterative process that involves providing information and soliciting input from the audiences addressed. In other words, the risk message should move not only from experts to nonexperts, but also from citizens to public decisionmakers.

The first step in an interactive risk communication and risk management process is to identify the affected and interested or relevant constituencies. The process of identifying constituencies is an ongoing activity. The Division initially selected six key constituencies that are particularly affected by climate change and are uniquely capable of participating in mitigation strategies or in communicating the risks of climate change to the public. Those six priority constituencies include the following groups:

- Meteorologists (especially weather broadcasters)
- Coastal communities
- Outdoor recreation and wildlife enthusiasts
- Public health professionals
- The business community (especially insurance companies and renewable energy businesses)
- State and local government leaders

Key Milestones

Although the Division has achieved many important results since the inception of the program, several accomplishments are particularly noteworthy:

Outreach and Publications

- The Division hosted 29 meetings and roundtables around the country with key constituency groups representing renewable energy, insurance, meteorology, health, coastal areas, outdoor recreation, and state and local government representatives.
- The Division also built working relationships with associations and trade groups representing a membership base of 2 million individuals.
- The Division also has produced numerous brochures, more than 116 fact sheets over a period of three years, close to a dozen exhibits, and approximately 96 other collateral materials to communicate climate change risks and solutions, including on-line issues of *Inside the Greenhouse*, an electronic publication featuring climate change information and mitigation success stories.
- Division staff members have published articles on climate change in magazines and newsletters that have a combined circulation of more than 103,000 readers.
- Almost 2,000 subscribers have joined the Division's targeted climate listservs, and listserv messages are delivered to each constituency group on a weekly basis.
- The Division's Website was chosen as a "Select Site" by the Dow Jones Business Directory, a sister publication of The Wall Street Journal; the site gets more than 300,000 visits per month.
- Two CD-ROM outreach kits (one for broadcast meteorologists and one for state and local leaders) have been produced and distributed to nearly 12,000 people and organizations.

Conference and Trade Show Attendance

- In FY1999 alone, there were in excess of 50,000 attendees at trade shows where the Division's climate exhibits were displayed.
- The Division has organized eight regional conferences and three workshops in states representing more than 93 percent of the U.S. population. These were all co-sponsored by an impressive list of key associations and regional stakeholders.
- The Division organized three conferences for state and local partners with representation from nearly every state
- Successful Coastal Cities Tour conferences in South Florida resulted in tangible action at the local level on climate change.

State and Local Partners

- Almost three-quarters of the states—35 states and Puerto Rico—have started or completed inventories of their emissions of carbon dioxide and other greenhouse gases.
- Half the states—25 and Puerto Rico—have established task forces that have started or completed action plans

that analyze options designed to curb their state's greenhouse gas emissions.

- More than one-third of the states initiated specific actions to address climate change, such as enacting legislation, initiating education programs, or setting up demonstration programs.
- Seventy-five cities participate in the Cities for Climate Protection Campaign, sponsored by the International Council for Local Environmental Initiatives. Those that have begun local actions have reduced greenhouse gases by 1.3 million metric tons of carbon equivalent (MMTCE) annually.

PROGRAM GOALS AND OUTREACH STRATEGY

Based on the science of climate change, the mission of the Climate Outreach and Innovations Division is to increase awareness of climate change and its public health, economic, and environmental impacts to affected and interested constituencies in order to foster strategic changes in behavior and policy that result in the reduction of greenhouse gas emissions.

Our mission, ambitious as it is, is broken down into three specific goals.

- Raise awareness among key constituencies and decisionmakers of climate change risks to provide them with a foundation for more informed risk management discussion and decisions.
- Assist critical parties, as requested, in outreach activities to broaden the level of effort aimed at informing stakeholders about climate change.
- Enable critical parties and decisionmakers to take voluntary mitigation actions that will lead to reductions of greenhouse gas (GHG) emissions and adaptation measures that will result in reducing the risk of climate change impacts.

From the outset of this program, a strategy was developed that has been quite successful and continues to be employed. Associations and organizations within each of the key constituencies were identified and contacted. The goal was to develop partnerships with these organizations so that we might work together to inform the organization's membership about the risks of climate change. Several methods of information dissemination were used including the following five tactics:

(1) Fulfillment of on-going information requests by associations and key stakeholders on the impacts of global warming;

(2) Development of a comprehensive global warming website;

(3) Production of targeted publications, brochures, and fact sheets;

(4) Attendance at conferences and events sponsored by our partner organizations in order to disseminate information;

(5) Creation of an electronic e-mail service for each constituency group; and

(6) Provision of grants and technical assistance for mitigation strategies and education programs.

ENHANCED OUTREACH TO AFFECTED AND INTERESTED CONSTITUENCIES

The Division identified a host of outreach and capacity-building activities to provide each constituency with the tools they need to understand climate change science and determine the impacts climate change could have on their interests. In addition, the program provides constituencies with information about the options and solutions available to them and the mitigation strategies appropriate to their circumstances.

Broadcast Meteorologists

The Broadcast Meteorologists group includes:

- 700+ local and national weather broadcasters and meteorologists
- Radio and television news directors

TABLE 1. Outreach Strategies by Goal for EPA's Climate Outreach Program

Strategies	**Goal 1** Raise awareness	**Goal 2** Perform outreach	**Goal 3** Enable parties to take voluntary mitigation actions
Host climate change educational events.	◆	◆	
Attend and staff exhibit booths at constituency conferences.	◆		
Sponsor roundtable discussions with stakeholders.	◆	◆	
Develop information products and publications.	◆		
Add new content to the global warming website.	◆		
Send weekly messages on the electronic listservs.	◆		
Continue to enhance ClimateLink.	◆	◆	
Build stakeholder networks.		◆	
Engage national stakeholder organizations and state/local officials.		◆	◆
Develop new and enhance existing regional/interagency partnerships.		◆	
Develop and distribute interpretive/educational toolkits and host workshops on how to use the kits.	◆	◆	
Implement Climate Smart State and Local Initiative.	◆	◆	◆
Provide grants to engage non-governmental organizations (NGOs) in communicating the risks of climate change.		◆	
Develop tools that assist states and localities and other organizations in taking voluntary mitigation actions (e.g. GHG calculators, outreach toolkits).			◆
Conduct analyses for states and localities (e.g. co-benefits).			◆
Provide technical assistance and grants to states doing greenhouse gas inventories and action plans.			◆
Provide grants for taking voluntary climate change actions or developing educational programs.			◆

Broadcast meteorologists represent one of the most effective channels of communication between the scientific community and the public. On a daily basis, broadcasters turn complicated weather and science data into information that is understandable for nonscientific audiences. Often filling the role as *de facto* local science reporters, most weather broadcasters also must explain general science information to viewers. For many viewers, broadcast meteorologists represent their only regular source of information on science.

In recent years, broadcasters have found themselves facing more frequent questions about climate change. As trusted sources for science information, broadcasters can provide viewers with a better understanding of climate change. However, broadcasters are constrained in their educational efforts by lack of access to scientific research and by tight station budgets that limit acquisition of educational resources. In response to these constraints and expressed needs, the Division spearheaded the formation of a climate change partnership with the National

Oceanic and Atmospheric Administration (NOAA) and the National Aeronautics and Space Administration (NASA) to share climate information and resources with weather broadcasters across the country. Information was packaged for use on the air and for educational presentations in the community—broadcasters frequently are invited to talk to school groups and civic organizations.

The EPA partnership with NOAA and NASA has increased awareness of the climate change issue within the broadcast meteorologist community. Through such products as the CD-ROM climate change presentation kit, the partnership's outreach activities are helping broadcasters increase the public's understanding of the issue. Through EPA's leading role in the partnership, the Division has enhanced its credibility with groups such as the American Meteorological Society, the Radio and TV News Directors Association, and the National Weather Association.

Business Community

The Business Community group includes:

- Renewable energy associations and the companies themselves
- Insurance industry executives and association representatives
- Green power marketers
- Tourism industry

Often business executives and strategic planners are largely unaware of the complex ways that climate change impacts may affect their sector and society. They may be committing their companies to long-term strategies and investments that will be out of sync with the directions that markets will move in order to reduce climate risks. Outreach that focuses broadly on climate impacts and risk reduction strategies helps businesses better decide how they need to adapt to remain relevant players in the long-term marketplace.

Key Sectors

Although the Division's outreach broadly covers most business sectors, the team also carries out targeted outreach to sectors that are particularly vulnerable to climate change risks, as well as those sectors that are key to risk mitigation. The outreach program is targeting the following sectors:

Green Power Sector

In deregulated markets such as in California and Pennsylvania, green power marketers are looking to credible sources such as EPA for information that they can use in their marketing efforts. Without a strong environmental message, green power marketers may find it difficult to overcome consumer resistance to switching to viable mitigation technologies such as renewable energy technologies because of perceived reliability problems and higher generation costs.

Insurance Sector

Insurers, in addition to being at risk themselves, are in a unique position to serve as credible and powerful messengers for adoption of adaptation strategies that reduce climate change risks and promotion of voluntary mitigation steps by all sectors. Insurers can increase awareness of the accelerating rise worldwide in property loss claims from more frequent and severe flooding and coastal erosion worsened by sea level rise. Insurance companies can share climate information with government and corporate risk managers, as well as policyholders. This sector can benefit directly from mitigation technologies such as electricity from generators powered by renewable sources so that claims from power disruptions after storms are reduced. On the financial side, the insurance sector may be able to create investment incentives for the broad use of mitigation technologies by offering lower premiums or lower deductibles for those who invest in measures such as energy efficiency.

Renewables Sector

Although information on renewables is included for each targeted sector, opportunities remain for providing renewables industries with updated climate change information for their own outreach and marketing.

Tourism Sector
Several U.S. regional economies depend heavily on tourism. In many cases the tourism sector is highly vulnerable to the potential impacts of climate change. For example, the ski industry is weather-dependent, as are amusement parks. Beachfront hotels on the Atlantic Coast and on some islands are vulnerable to sea level rise. Increased awareness can spur voluntary mitigation activities such as the use of renewable energy and improvements in energy efficiency. Hotels are major energy consumers and can play a significant role in mitigation and communication of climate change impacts.

Coastal Communities

The Coastal Community group includes:

- Travel and tourism groups
- State economic development officials
- State coastal zone managers
- Nongovernmental organizations

This constituency contains a substantial percentage of the U.S. population, as more and more people move to coastal areas. Coastal communities are vulnerable because rising sea levels and worsening storm surges, thought to be potential impacts of climate change, lead to increased beach erosion and resulting loss of homes and wetlands, as well as other local economic hardships. As sea levels rise, estuaries and municipal water supplies are likely to be adversely affected by increasing salinity. All those who live in or visit coastal communities or eat fish dependent on estuaries may be affected.

The travel and tourism industry "crosswalks" several affected and interested constituencies, specifically coastal communities, state and local governments, the property casualty insurance and reinsurance industries, and wildlife and outdoor recreation enthusiasts. This integration of constituencies builds a platform for communicating the risks of climate change with maximum efficiency.

Two major efforts were conducted to reach coastal stakeholders—Coastweeks and the Coastal Cities Tour in South Florida. Coastweeks is a three-week national celebration of America's coasts. EPA's staff traveled the Atlantic Coast giving talks on climate change and sea level rise, and the coastal outreach team distributed information at local Coastweeks events. The Coastal Cities Tour consisted of a series of stakeholder meetings and conferences on climate change coordinated with local groups in South Florida. As a result of these efforts, partnerships were formed with local government and business groups, and the local groups made a commitment to expand their own climate change outreach efforts.

Wildlife and Outdoor Recreation Group

The Wildlife and Outdoor Recreation Group includes:

- National park managers
- State natural resources officials
- Hunters and anglers
- Campers
- Wildlife observers
- Outfitters
- Recreational sporting institutions and businesses

Millions of Americans may be affected by habitat destruction resulting from climate change. Approximately 50 million people engage in recreational fishing every year, and recreational fishing is a $24 billion industry (1991 dollars). Recreational fishing is vulnerable to climate change because rising temperatures and changes in precipitation can reduce or eliminate habitat for cold- and cool-water fish. Major dieback of northern forests and die-off of plant and animal species that are dependent on those habitats may lead to lost recreational opportunities for hunters, campers, hikers, and wildlife observers.

Outdoor enthusiasts have expressed a need for specific information identifying the wildlife and wildlands that are particularly vulnerable to climate change impacts. In response to that need, an outreach kit is being developed that will provide climate change information and learning tools for park interpreters to disseminate to visitors. This kit is being developed in partnership with the National Park Service.

Medical and Public Health Professionals

The Medical and Public Health group includes:

- State and local public health officials
- Physicians
- Nurses

Potential impacts of climate change on human health include direct consequences such as heat stress-related mortality and deaths due to weather variability. Indirect effects are another possible consequence through climate-induced changes in the geographic range and incidence of vector-borne diseases or through climatic influences on environmental health hazards (e.g., effects on the levels of ambient concentrations of air pollutants and associated impacts on respiratory illnesses).

Medical and public health professionals, especially physicians, are influential in their communities and credible to affected parties. Doctors, nurses, and public health professionals have well-organized networks with clearly established outlets for communicating with non-experts. The medical and public health community is best qualified to communicate the potential consequences to human health.

Two major professional organizations, the American Medical Association and the American Public Health Association, are well organized and can reach almost everyone in the medical and public health community. In 1998, our Division collaborated with these two highly respected groups, along with the Centers for Disease Control and Prevention, the National Institutes of Health, and others to convene a highly successful conference of health professionals to discuss the risks of climate change.

State and Local Governments

The State and Local Government stakeholder group includes:

- Leaders of state and local government (e.g., governors, mayors, commissioners)
- Heads and staff of state and local governments agencies, especially the directors of air, energy, utility, natural resources, and environment agencies
- State legislators
- National associations that support the functions of state and local governments: National Governors' Association, Environmental Council of the States, State and Territorial Air Pollution Program Administrators/Association of Local Air Pollution Control Officials, National Conference of State Legislatures, National Association of State Energy Officials, National Association of Regulatory Utility Commissioners, American Association of State and Highway Transportation Officials, U.S. Conference of Mayors, International City/County Managers Association, National Association of Counties, National League of Cities, International Council for Local Environmental Initiatives, National Association of Local Government Environmental Professionals

The objectives of the State and Local Climate Change Program are to focus attention on potential economic and environmental impacts of climate change, analyze viable technology and policy responses, and enable public sector partners to develop response strategies that reduce greenhouse gas emissions.

EPA's State and Local Climate Change Program has engaged in meaningful capacity-building and outreach activities at the state and local levels since the early 1990s. The program offers a full range of technical and outreach assistance including:

- Guidance documents to help states and communities inventory greenhouse gas emissions and develop action plans to reduce those emissions.
- Assistance in conducting action plans, demonstration projects to showcase innovative initiatives, and state-based outreach programs.
- Educational materials in the form of tool kits, web-based materials, searchable databases, case studies, listserv messages, CD-ROMs, and electronic newsletters.

PROGRAM CONCLUSIONS

This year we have started two exciting new initiatives. ClimateLink is an on-line forum that links people, information, and ideas on topics related to climate change (http://www.epa.gov/globalwarming/climatelink). ClimateLink also is a one-stop source for EPA's educational and outreach materials on global climate change. This new service, available on EPA's global warming website, provides timely e-mail news reports on climate change and its potential impacts. The e-mail news reports are targeted to each of our stakeholder groups. Some of the features available or planned for ClimateLink include: examples of successful outreach efforts; outreach materials that can be ordered; on-line tools such as a greenhouse gas calculator; an on-line discussion forum; and links to other resources on climate change.

In addition, we have launched the Climate Smart State and Local Initiative. This program is targeted specifically to state and local leaders to encourage them to voluntarily reduce their greenhouse gas emissions. Through this program, information will be offered on the co-benefits of reducing greenhouse gas emissions, emissions reduction technologies and policies, the economics of reducing greenhouse gas emissions, and opportunities for partnering with state and municipal governments. A CD-ROM toolkit was created to kick off this exciting new program (http://www.epa/gov/globalwarming/publications/outreach).

During the past three years, our Division has learned some lessons that might be useful to others who have similar outreach programs. We have learned, for example, the importance of working with associations to leverage our outreach. Associations are credible spokespeople for many of the vulnerable populations we are trying to reach. Spending time to educate associations about the impacts of climate change has resulted in a multiplier effect. Our efforts to educate a number of associations result in those associations educating their large membership. Sometimes these members take the process a step further and educate their communities. What we can do with our limited resources can be multiplied many times when associations become engaged in helping inform the public.

Targeted messages, we've learned, are very important to reach specific audiences. In addition, we find that we need to include information on what people can do to address the problem of climate change and/or reduce their risks to the impacts of climate change. Whether in publications or in direct contacts with our constituencies, we emphasize specific steps that people can take to reduce their greenhouse gas emissions.

The U.S. EPA has received and continues to receive many requests for materials on climate change. It is important to determine the preferred approaches of the associations for communicating with their constituencies. All of the associations have limited time and resources. Hence, it is important to provide materials that fit into their formats for distribution and to take into account their opinions of what works best for their members.

We have realized that obtaining the best currently available science is critical, especially when it comes to information on potential local and regional impacts. Obtaining this kind of information is a challenge, however, since the science on many aspects of global warming at the local level is still developing.

Perhaps one of the greatest challenges is making this issue real for people. To many, it seems abstract and far off in the future. Information on local impacts seems to be a big part of meeting that challenge; people react to what they believe is going to happen to them personally. In the case of local and state leaders, they need to understand that policy decisions made today have long-term impacts on infrastructure. The 29 roundtables and regional conferences that we hosted around the country helped us to promote open and interactive two way dialogue between EPA and regional stakeholders as well as to provide informal "face to face" opportunities for stakeholders to sit down with EPA. We hope that this helps set the stage for cooperative ventures with EPA and its regional offices and continues to bring home this issue for people and their communities. We also hope that our soon to be released greenhouse gas calculator, tailored for the individual, will assist in making this issue relevant to people's daily lives.

Another challenge we're grappling with is finding new ways to measure and report our program's successes. To date, the primary measurements have been in terms of "impressions"—in the current language of integrated marketing communications. Our Division, as we mentioned earlier, has produced more than 200 publications in three years; contacted more than 50,000 people at trade shows in one year alone; received more than 100,000 impressions in magazines and newsletters; and reached over 1,000,000 web users in a year.

But are not resting on our laurels. We are working to expand our contacts with our existing partners to enlarge our network to include new partners. Our new ClimateLink and Climate Smart initiatives are aimed at exactly that goal. ❑

Communication and Engagement: A Review of Strategies from the Great Lakes-St. Lawrence Basin Project

Linda Mortsch

The Great Lakes – St. Lawrence Basin (GLSLB) Project on "adapting to the impacts of climate change" was an integrated climate impact assessment. The communication and stakeholder engagement processes occurred at a number of scales. At the overall GLSLB Project level, Basin policy- and decision-makers (e.g., International Joint Commission, Council of Great Lakes Mayors, Great Lakes Commission) were engaged. For studies in the Grand River Basin and the Bay of Quinte Watershed, the dialogue was with resource managers or "practitioners". Key considerations for effective communication includes audience, messages and method of communication. Construct a picture of the impacts. Discuss certainties or points of consensus instead of focusing on the uncertainties. Provide clarification on the urgency, impacts, and action needed. Illustrating the vulnerability of key policies to climate change was very successful. One of the primary outcomes from this impacts research was to develop climate change adaptation strategies. Adaptation strategies should not be developed in a "top down" manner so communication was used to initiate partnerships and build capacity. Stakeholder engagement leads to commitment, ownership, and action on the climate change issue.

INTRODUCTION

The Great Lakes – St. Lawrence Basin (GLSLB) Project on "adapting to the impacts of climate change and variability" attempted an integrated assessment of the impact of climate change in the Basin. While it was recognized that biophysical impacts and socio-economic impacts were important considerations, adaptation and communication were incorporated as new components of a successful impact assessment (Mortsch and Mills, 1996; Mortsch *et al.*, 1997). This paper outlines some of the climate change communication challenges and the methods that were used to engage groups in the climate impact assessment process and to communicate results to them.

WHY COMMUNICATE?

Much effort has been expended to research the causes of climate change, the impacts of climate change, and the mitigation and adaptation responses to climate change; yet, there is a barrier between the science-policy link (Klabbers *et al.*, 1996). Included in this barrier is the challenge of communicating research results to "interested publics" (industry, governance, non-governmental organizations, other researchers and the general public). The climate change issue often overwhelms people by the scale, complexity and the magnitude of the impacts and required responses while others deny that the problem exists and that action should be taken. Scientific results from climate impact assessments often are "too complex, to uncertain and full of jargon" for the lay public, policymakers and decision-makers to understand yet act upon (Andrey and Hachey, 1995; Carpenter, 1995; Berk and Schulman, 1995). However, communication can play an important role in affecting the technical, economic, social, cultural and political change needed to implement greenhouse gas reduction policies as well as adaptive planning and management. The challenge for communicating climate change "effectively" is imparting information in a three stage continuum to: 1) raise awareness; 2) confer understanding and competency; and 3) motivate action.

COMMUNICATION IN THE GREAT LAKES – ST. LAWRENCE BASIN PROJECT

Communication in the GLSLB Project was initiated at different scales – at the Project level by the Project coordination team and within individual studies such as the Grand River Basin and the Bay of Quinte Watershed Remedial Action Plan (RAP) by study leads and the Project team. In the communication effort, key items were considered: the audience, the messages and the method of communication. These items will be discussed.

Communication at the GLSLB Project Level

At the large scale of the Basin, communication was directed to key policy-, decision-making and research bodies involved in setting strategic directions. Some of the important organizations included: International Joint Commission (Science Advisory Board and the Commissioners), Council of Great Lakes Mayors, Great Lakes Fisheries Commission and the Great Lakes Commission. The most successful method of communication was face-to-face presentations at specially arranged meetings or at annual conferences. These groups needed an opportunity to question and discuss the strategic implications of climate change. The GLSLB Project Steering Committee was instrumental in arranging this level of interaction. The Project reports, the newsletter *Adaptations* and the website provided reference material. Climate change information was disseminated to a larger audience through these organizations' annual reports (IJC, 1995), newsletters and annual meetings (as motions of support for a binational GLSLB climate change Project).

Climate change science and impacts information that resonated with the group was: trends in greenhouse gases over the past 1000 years and fossil fuel use, increases in global and Canadian temperatures, scenarios of temperature and precipitation changes in the Basin, reductions in Great Lakes levels and flows, and fisheries habitat changes. If key policy targets such as water quantity management, fisheries management or remediation efforts were vulnerable, climate change became an issue to consider but not necessarily to act upon. "No regrets" adaptation strategies, actions on climate change that corrected other known environmental issues (e.g., water conservation), were the responses that were of interest.

Communication at the Study Level

The communication at the study level often involved the resource managers or "practitioners" who were more interested in management issues.

Bay of Quinte Watershed

The climate impact assessment of the Bay of Quinte Watershed built upon existing research for the Remedial Action Plan (RAP). For the RAP, a hydrological and water quality model was used to define water quality loading problems and assess the management options for remediating point source (e.g., sewage treatment improvements) and non-point sources (land use management changes). Implications of climate change scenarios for water quantity and quality in the Bay of Quinte watershed were analysed using this tool (Walker, 1996). The results of this preliminary climate impact assessment were shared with Quinte stakeholders through a series of presentations and workshops; this was an extremely effective communication tool. The results made the issue "real". The groups in the outreach process included: Citizens' Advisory Board for the RAP, the RAP co-ordinator, Heritage Canada (manages the Trent-Severn Waterway), marina operators and Municipalities within the watershed. Key climate change information for this group was the hydrologic and water quality impacts. Modelling results indicated a change in the amount and duration of snowcover, a reduction in mean annual flow with more low flow periods but still flooding events. Water quality (as measured by an increase in phosphorus concentrations) decreased and in some instances the RAP targets were not met. It concerned the Quinte stakeholders that the investment in "cleaning-up" the watershed through land stewardship improvements and enhancement of water treatment could be compromised and low flows and lake levels could affect recreational opportunities in the watershed and the Bay. A Climate Change Action Committee has been form to continue with climate change impacts research, development and costing of adaptation strategies and communication. The Committee needs to secure funding for their proposals (e.g., Climate Change Action Fund (CCAF)).

Grand River Watershed

The Grand River has had a series of impact assessment studies on the biophysical implications of climate change on its watershed (Sanderson, 1993). Another study was initiated specifically to analyse management and adaptation implications of climate change. The Water Use Analysis Model (WUAM) was used as a framework for assessing the success of meeting water management targets within the basin under scenarios of climate change (Southam *et al.*, 1999). The system response was analysed in terms of target flow satisfaction and flow frequency distribution. Grand River Conservation Authority (GRCA) water management staff were instrumental in facilitating presentations to Committees, participation on Technical Working Groups and a survey of Grand River water management stakeholders. The climate impact assessment results were timely in that they could inform the "Grand Strategy" development process. The Grand Strategy is a strategic document for long-term water management in the watershed and addresses hydrology/ground water, water quality, fisheries management, growth and development and heritage, tourism and recreation. Climate change implications were communicated on these themes. However, the climate change information was not specific enough to be incorporated into the Strategy in a rigorous manner; it could only identify vulnerabilities such as cold water fisheries and waste water assimilation. The next challenge is to provide quantitative risk information. The GRCA has become aware of and knowledgeable about the climate change issue. It has secured CCAF funding to lead research to address climate change issues relevant to their watershed.

WHAT SHOULD BE COMMUNICATED?

In communicating climate change in the GLSLB Project, some key practices emerged. They include communicating:

- trends and changes in greenhouse gases, climate elements (e.g., temperature, snowcover) and impacts (hydrologic changes);
- climate change scenarios as "practice climates" and promoting them as an opportunity to assess vulnerabilities and opportunities in "what if" exercises;
- certainties of climate change (e.g., natural "greenhouse effect", greenhouse gases are increasing; link to climate, and climate impacts);
- impacts by "painting a picture" through imagery that is relevant to the local context;
- individual actions and policy responses that are needed; and
- success stories to overcome a sense of helplessness and demonstrate appropriate action.

SUCCESSFUL COMMUNICATION AND OUTREACH

The goal of communication in climate impact assessment is development of partnerships and mutual learning in order to progress to developing and implementing mitigation and adaptation strategies. People and organizations want to "see themselves", their interests and concerns, reflected in the communication and outreach. A 'balanced" presentation develops trust for the climate impact assessment information and a recognition of the risks and opportunities for the region. Adaptation cannot progress in a "top down" fashion; it must be developed and promoted by stakeholders. Ideally once the stakeholders have gained awareness and understanding, they have the capacity to act by conducting further climate impact assessment research based on their questions and needs for defining vulnerabilities and opportunities and to develop, assess and implement adaptation strategies. This is "true" integration in climate impact assessment. ❑

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Session D 5

CLIMATE CHANGE CURRICULUM DEVELOPMENT STRATEGIES

Climate Change in School: Where Does it Fit, and How Ready are We?
Rosanne W. Fortner
Ohio State University

Climate Change Education - Understanding the Challenges
David Lunn
SEEDS Foundation

Educational Outreach Approach of the Climate Change Research Center
D. Zachary Smith
University of New Hampshire

Climate Change in School: Where Does it Fit, and How Ready are We?

Rosanne W. Fortner

Research indicates teachers place a high priority on climate change as a topic their students should know, but report their own knowledge as inadequate for teaching it. Students (and some teachers) seem unable to distinguish among related environmental issues, and treat general "environmentally friendly" behavior as affecting all issues. The curricular fit of global climate change is best in Earth systems oriented classrooms but opportunities exist across the curriculum; instructional materials are available, though these may not address misconceptions. Some interest groups oppose human-mediated climate change as a curriculum topic, for the same reasons they oppose public action on the problem.

BACKGROUND

Just as the concept of organic evolution serves as an organizer for modern biological science, global climate change (GCC) is focusing the attentions of the Earth science community, justifying the need to organize its many disciplines. Like organic evolution, GCC is complex and involves scales of time and space not well understood by the adult public. And like evolution, public opinion surveys (over 30 in the past decade) indicate a mix of attitudes and a wide range of knowledge levels about its science. On the whole, however, a majority of Americans seem to believe that global warming (used synonymously with GCC) is a serious threat to their life as well as a reality (e.g. Fortner, et al. 2000, Gallup 1997, Krosnick and Visser 1998, Pew Research Center 1997). Nevertheless, people see this issue as being different from others in its level of uncertainty and intangibility, and so may confront it differently in making personal choices (Lee and Fortner 2000).

Should a topic with such high media attention and potential impact, even though it is complex, uncertain, and intangible, be included in the school curriculum? Preparation for the responsibilities of citizenship in a global society, as well as development of individual sustainable lifestyles, should dictate that GCC appear in formal education. Indeed, science curriculum restructuring efforts in the United States insist that reform should involve aspects that favor instruction on GCC:

- "Science in personal and social perspectives" is a content area within the National Science Education Standards for the U.S. The subject matter includes *Changes in Environments* and *Science and Technology in Local Challenges* (NRC 1996).
- Interdisciplinary curriculum is a goal for science literacy. Benchmarks (1993) defines the concept as applying to 1) integrated planning across disciplines, 2) interconnected knowledge, and 3) coherence of student experiences.
- Global climate change and the composition of the atmosphere are included in the Earth and Space Science standards for Grades 5—8 and 9-12.
- A specific Benchmark for Grade 12 is, "Like many complex systems, ecosystems tend to have cyclic fluctuations around a state of rough equilibrium. In the long run, however, ecosystems always change when climate changes…" (AAAS 1993)

A lesser known K-12 curriculum restructure effort, Earth Systems Education (Mayer 1995), and its higher education counterpart, Earth Systems Science Education, use global climate change as a unifying topic because it so vividly reflects the interrelationships of the model proposed for the National Aeronautics and Space Administration (Earth System Science Committee 1988, and http://www.usra.edu/esse/BrethColor.GIF).

Earth Systems Education (ESE) is based on the simple premise that Science is a study of Earth (Mayer and Fortner 1995), therefore all of science education K-12 can have a common theme. The scientists, science educators and teachers who developed the Earth Systems concept at this level in 1988 identified seven Understandings into which the important aspects of science education could basically fit. They include not only the interrelationships of the earth subsystems (hydrosphere, atmosphere, lithosphere, biosphere), the processes and tools of science, and change over time, but unique statements that foster stewardship of Earth systems and aesthetic values of Earth. An Earth Systems focus increases the curriculum possibilities for global climate change education.

Figure 1. Framework of Earth Systems Understandings

1. Earth is unique, a planet of rare beauty and great value.
2. Human activities, collective and individual, conscious and inadvertent, affect Earth systems.
3. The development of scientific thinking and technology increases our ability to understand and utilize Earth and space.
4. The Earth system is composed of interacting subsystems of water, rock, ice, air and life.
5. Earth is more than 4 billion years old, and its subsystems are continually evolving.
6. Earth is a small subsystem of a Solar system within the vast and ancient universe.
7. There are many people with careers and interests that involve the study of Earth's origin, processes and evolution.

STUDENT IDEAS ABOUT GLOBAL CLIMATE CHANGE

Educational strategies are best designed when they are based on knowledge of the learners' level of knowledge and preconceptions. Information can be selected and experiences organized to fill known knowledge gaps, enhance understanding of relationships, and remediate misconceptions. In the last part of the 20th Century a number of researchers probed student understanding of GCC, its causes, consequences, and "cures." In general, secondary school students (ages 11 and up) know that GCC will be associated with changes in weather patterns, and they can basically describe how the greenhouse effect works to increase temperatures in the lower atmosphere (Boyes and Stanisstreet 1993).

Misconceptions

However, these students, as well as college students and preservice teachers, frequently hold incorrect perceptions about Earth system relationships as well as how human activities impact those systems. Results regarding misconceptions are remarkably similar across education levels. The most common student misconceptions, according to a synthesis by Gowda, Fox and Magelky (1997) are:

- Inflated estimates of temperature change (11°F/decade,compared to IPCC estimates of 0.5 F)
- Confusion between CFCs, the ozone hole, and climate change (ozone layer depletion causes climate change; stop using aerosols to prevent global warming)
- Perceived evidence – warmer weather (reportedly they could personally sense rising climatic temperatures or changes in long-term weather)

- All environmental harms cause climate change (aerosols, acid rain, even solid waste disposal)
- Confusing weather and climate

Specific studies among student populations are summarized in Table 1. Apparently the data reflect a general level of misperceptions, as Aron, et al. (1994) found that junior high to teacher prep students had low knowledge and numerous misconceptions about atmospheric phenomena in general. It is significant to note that fewer than 3% of U.S. students have access to high school Earth science courses, where such material would be taught.

Methods of research

Recent research has identified methods appropriate for analyzing the concept relationships upon which students are basing their perceptions. For example, Boyes and Stanisstreet (1998) focused on how high school students relate skin cancer to global environmental effects. Large numbers of the students confused the action of heat rays with that of UV rays, and along that line of thinking they believed that raised temperatures (from the greenhouse effect) were guilty. Using an 11-item questionnaire, the researchers analyzed the percentage of students that linked the various concepts, and were able to diagram overlapping connections to find that only 9% selected and were confident in the correct explanation.

Rye and Rubba (1998) tested the use concept maps as part of an interview schedule to explore the relationships among the ideas student hold. Despite the value of the mapping tools demonstrated in other research (e.g. Heinze-Fry and Novak 1990), and the confidence teachers have in the techniques of concept mapping for organizing ideas, the use of concept mapping did not contribute additional insights beyond the interview notes.

The same researchers had used expert concept maps as part of teacher preparation for teaching an instructional unit on global warming (Rubba and Weisenmayer 1993). Perhaps they were useful for the teachers in planning and organizing. The instructional unit, however, represented one of the first attempts to gauge the impact of instruction on alteration of misconceptions about global warming and ozone relationships. Rye, et al. (1998) found that students' prior misconceptions "limit and confound their understanding of the nature, causation and resolution of global warming" (p. 544). Over half the students in the post-instructional study believed that ozone layer depletion caused global warming. The researchers recommended that teachers address the issues at separate times and with different materials so that confusion and overlap of concepts is not facilitated in the learning process. Of course, additional teacher preparation in the facts of physics related to these phenomena is needed as well.

TEACHER KNOWLEDGE AND PRIORITY FOR CLIMATE CHANGE EDUCATION

Despite the evidence that teachers hold some of the same misconceptions as their students about global climate change, many place a high priority on the topic as part of their students' education. Studies conducted among teachers in the Great Lakes region (Fortner and Corney, in preparation) found that middle school science teachers (N= about 100 per state/province in Ohio, Michigan, Indiana, Illinois, Wisconsin and Ontario) rated global climate change as a priority of 3 out of four, but only 26% (77 out of 300) considered the topic one of their top five "highest priorities." They indicated that their own knowledge level was also at a level of about 3. A similar survey given to all secondary science teachers in the Republic of Cyprus in 1999 resulted in lower ranking for the issue among others tested. The 120 responding teachers (67% of the population) rated global warming as the 7th priority issue out of 12, but still gave it a high mark (average response 3.5 out of 4). Knowledge levels were rated at 3.2. The top issues for Cyprus teachers were ozone hole, air pollution and acid rain. Interestingly, the ozone issue ranked 3.9 in priority and teachers' knowledge was reported at 2.8. (Fortner and Constantinou, in preparation). Anecdotally, in a global data workshop conducted by the author, Cyprus teachers presented with a list of 20 Internet sites to visit chose the ozone hole site as either their first or second exploration.

Teachers and global climate change were the subjects of other studies with different aspects to offer. A group of teachers in an inservice program about GCC appeared to feel strongly that their own behavior serves as a model

Table 1: Examples of 1990s Research on Student Awareness of Global Atmospheric Issues				
Author	**Date**	**Subjects**	**Methodology**	**Findings**
Boyes and Stanisstreet	1997	Ages 11 - 16 in UK	Questionnaires and Interview	• Some misconceptions decrease with age. • Actions against any pollution will decrease GW. (General thinking about envir. issues.) • Environmental Education should come early, before misconceptions are ingrained.
Boyes, Chuckran and Stanisstreet	1993	Grades 5-10, N=702, USA	Closed-form questionnaire, factor analysis	• Personal responsibility for any good actions will prevent GCC. • Common consequences for all issues. • Slow leakage of pollutants poisons world.
Francis, Boyes, Qualter and Stanisstreet	1993	Age 8-11 in UK, N=563 from 5 schools	Questionnaire and interview of subset (portions of Boyes instrument)	• Friendly actions to control g-house effect • Driving harms by leaded fuel, like aerosols • Some misconceptions decline with age • Early education could counter misconceptions
Groves and Pugh	1996 (Publ. 1999)	U.S. College students N=330 science, education, other	Questionnaire (Boyes)	• Science majors higher than education • Causal relationships between issues • Confuse causal factors & remedial actions • Many don't recall formally learning issues
Gowda, Fox and Magelky	1997	High School students N=99, Hawaii and Oklahoma	Open-ended questionnaire plus T/F questions	• Inflated estimates of temperature changes • Confusion on CFCs, Ozone hole and GCC • Climate =weather, they felt GCC • All issues cause GCC • Misconceptions from media, judgmental heuristics, fuzzy environmentalism • Trusted sources are scientists and teachers
Dorough, Rubba, Rye	1995	Grades 5-6	Interviews after STS instruction	• Ozone depletion causes warming
Rye, Rubba & Weisenmayer	1998	Middle school	Interviews after STS instruction	• Ozone depletion causes warming • CFCs destroy ozone and cause warming
Morgan and Moran	1995	University Students	Questionnaire and interview	• Misunderstanding of GCC and Ozone hole

for their students. Interview and journal data demonstrated they were conscious of showing best practice regarding their personal responsibility for global climate change (Rubba and Rye 1997). The teachers appeared to believe that "if teachers show active interest and involvement in taking citizenship action, then students are more likely to do the same" (p. 82).

CURRICULUM ENTRY POINTS

If we chose to include global climate change in the curriculum, where would it fit? The possibilities are numerous, and a teacher determined to include the issue will find ways to make it fit. Some caution is required based on students' mental functioning levels: concrete versus abstract understanding. Elementary students below age 12, and many who are older, are not at appropriate stages of cognitive development to deal effectively with the magnitudes of space and time encompassed by the concept of climate as opposed to daily weather. The ozone hole especially is an intangible idea that should be avoided at early ages to prevent confusion with weather experiences. There are some tangible experiences that can demonstrate the greenhouse effect, but on the whole the key concepts for understanding climate change are very abstract and beyond the mental preparation of elementary students. More instruction will not change this physiological situation.

Some of the more obvious curriculum choices for secondary science, with examples, are:

- Biology/life sciences: carbon cycle, types of producers, effects of environmental conditions on living things (proxy data such as tree rings, coral banding, etc), physical requirements of habitat, impact of previous climates in earth history
- Chemistry: water quality changes related to quantity (dilution); precipitation analysis, CO^2 sources and testing, analysis of soils, insulating properties of CO^2
- Physics: light spectrum, heat vs. temperature, density and distribution of gases, mechanism of greenhouse effect, energy budgets, atmospheric and oceanic movements, etc.
- Earth/Space science: atmospheres on other planets, Earth's historic climates, ice ages, climate, atmospheric and oceanic movements, geographic relationships, land vs. water in energy relationships, foundation for support of life, proxy data from fossils and ice cores, natural contributions such as volcanic emissions, etc.
- Environmental Science: (not a common curriculum, but full of opportunities) issue analysis, components of viewpoints, science and society issues, economics of decisions, etc.

Schools using Earth Systems Education as an organizer for learning will have little difficulty using questions about global climate change to address all of these science components in relation to each other, whereas in a standard curriculum the physics class would not consider the biology, the chemist could ignore the space science, and so on. With Earth Systems Education the topic could also be enriched with activities in other subject areas. For example the art of the Little Ice Age period is noticeably different in its composition, with more scenes of skating on rivers, iced limbs of trees, and such, than periods before and after the mid-1800s. Paintings after the eruption of Krakatoa have more red tones in the skies. It is also possible within Earth systems classes to openly discuss how decisions are made on environmental issues, and what options are available to deal with the problem. Environmental decision choices should not be suggested to students, but they should be assisted in analyzing the costs and benefits of choices.

PROGRAMS AND MATERIALS FOR TEACHING

The materials produced by the Earth Systems Education Program at Ohio State (http://earthsys.ag.ohio-state.edu) are a starting place for teaching both global and regional aspects of global climate change. The two books of activities are

- *ACES (Activities for the Changing Earth System)*, produced with NSF support (Mayer, et al. 1993) with ten activities each for middle and high schools, including some on natural contributors to atmospheric features, such as volcano explosivity and solar distance.
- *GLIMCES (Great Lakes Instructional Materials for the Changing Earth System)* by Fortner, et al. (1995), sponsored by NOAA, Ohio Sea Grant. This book of activities includes terrestrial and aquatic changes predicted by scientists for the Great Lakes region.

All Earth Systems activities are based on principles of learning by becoming involved in inquiry. They begin with an important question, such as: After the maples, then what? Should we develop winter or summer recreation? How have all the species gone? When they begin with such a reason to do science, students are more eager to search for information and synthesize it. They find new ways of communicating their knowledge in group learning situations and demonstrating capability through alternative assessments. This is the way lasting learning is constructed.

Other groups have made collections of instructional activities available: EPA and NOAA have collections, and NOAA (through support from the Office of Global Programs) includes a listserve with teacher workshop participants receiving regular updates on climate events. Educational clearinghouses now compile lists of available materials, so any teacher wishing to address the topic may find assistance in existing publications. A few are cited below, and the hard-copy materials are of course supplemented by many excellent collections of web sites like those in Teacher Links (http://www.eecs.umich.edu/mathscience/teachers.html) and Earth Today (http://

earthsys.ag.ohio-state.edu/earth_today.html).

Cavanaugh, M. (1998). *Annotated bibliographic citations of global change resource materials.* Akron, OH: Environmental Education Council of Ohio. (ad388@acorn.net)

Great Explorations in Math and Science (GEMS). Curriculum for global climate change is sold by the GEMS program at: Lawrence Hall of Science, University of California, Berkeley, CA 94720 Phone: (510) 642-7771

Henderson, S., Holman, S.R. and Mortensen,L.L. (1993). *Global climates – Past, present and future. Activities for integrated science education.* Washington, DC: Environmental Protection Agency (EPA/600/R-93/126) Free.

Mortensen, L. (1994). *Global Change Education Resource Guide.* Silver Spring, MD: NOAA Office of Global Programs.

Transparencies for teaching: http://www.fsl.noaa.gov/%7Eosborn/CLIMGRAPH2.html Free.

http://hepg.awl.com/weiss/e_iprojects/c08/chap08.htm is a data-use and problem solving site on global warming designed by Addison Wesley to accompany and elementary statistics text. Free.

ENVIRONMENTAL EDUCATION DETRACTORS

Some of those who wear the name of "environmental educators" are advocates with a mission but without substance. This is unfortunate, for it places the profession in a defensive position. Better definition of roles, and perhaps subdivisions of the name, would go far to explain motives, but the mission of real environmental education is so urgent that few consider definitions a worthy use of time. As a result, the field seems constantly at odds with detractors.

In the past few years some conservative organizations, including those whose economic base is perceived to be threatened by moves to curb CO^2 emissions, have broadcast wide criticisms of environmental education (e.g. Adler 1992). The Internet site for EELINK.NET reviews the criticisms and responses at http://neeap.uwsp.edu/NEEAPServices/Newsletters/1994_1998/f96re.htm . The topics of the criticism can be classified as:

1. EE is often based on emotionalism, myths, and misinformation.
2. EE is often issue-driven rather than information-driven.
3. EE typically fails to teach children about basic economics or decision-making processes, relying instead on mindless slogans.
4. EE often fails to take advantage of lessons from nature, and instead preaches socially or politically correct lessons.
5. EE is unabashedly devoted to activism and politics, rather than knowledge and understanding.
6. EE teaches an anti-anthropocentric philosophy man is an intrusion on the earth and, at times, an evil.

Environmental educators can respond reasonably to each of these criticisms based on the methods and materials most practitioners use. It is easy to see from the list, however, where global change education could fit into the attacks. The environmental education community offers an additional note about why EE is necessary (Table 2), and the reasons clearly support climate change education. The best defense against detractors, however, is for the educator to be able to demonstrate credible scientific data behind the lessons being used.

CONCLUSION

Students from elementary school to college, and in a number of countries, have a general understanding of a range of environmental problems, and a set of environmentally friendly behaviors. They appear to recombine the two lists on a fairly generic basis, as if any friendly behavior is useful to counter any environmental problem. In addition, the characteristics, causes and effects of the issues get blended so that most problems seem to be interrelated.

There are ample materials for teaching about global climate change, many credible and free sources of sound scientific information, and numerous places where the topic could fit into the curriculum. However, with an overcrowded curriculum and with little interdisciplinary training, teachers may be reluctant to infuse information about a topic that is inherently intangible and uncertain. If the education of students on GCC is left to television, as Boyes and Stanisstreet (1992) suspect, misconceptions may go unchallenged or no education may occur at all.

Table 2. "A Dozen Reasons Our Country Needs Environmental Education"
Judy Braus, World Wildlife Fund

◆ Builds Better Citizens	◆ Builds Better Workers
◆ Advances Excellent Education	◆ Develops A Sound Ecological Foundation
◆ Promotes Tolerance for Diverse Views	◆ Creates A Nation of Critical and Creative Thinkers (Teaches how to think, not what to think)
◆ Links Disciplines	◆ Helps Learners Resolve Conflicts
◆ Links Human Health with Environmental Health	◆ Doesn't Shy Away from Values Education
◆ Works For A More Sustainable Future	◆ Reaches Out to All Audiences/Promotes Social Equity

When teachers place high priority on a topic, as those in recent studies have done for climate change, they may generate an internal incentive to learn enough about it to teach it. Providers of teacher education should become aware of these priorities and make learning opportunities available. It is critically important to remember that today's teachers did not study this topic in school, nor were they likely to study interdisciplinary sciences. The media they use for self-education may be deficient. Teachers, like their students, are likely to possess deeply held misconceptions and confused issues, and overcoming these is difficult. For teachers and students to learn, a first step is pre-assessment of conceptual linkages. Only then can instruction be structured to counter insufficient or inaccurate information (e.g. Smith, et al. 1993). ❑

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Climate Change Education - Understanding the Challenges

David Lunn

Never before in the history of curriculum development has a topic received so much attention. But what's driving this attention? This curriculum development is driven largely by the federal government's Public Education and Outreach sector of the Climate Change Action Fund. Numerous groups are using these funds to develop programs for public education. While the number of programs available to educators presents it's own set of challenges, a larger challenge is finding space and fit within the already crowded curricula. Overcoming these challenges requires an understanding of curriculum and teaching as well as climate change.

INTRODUCTION

Climate change is one of the most challenging issues we face. As science seeks evidence to provide more definitive answers regarding natural variability versus human forcing, we see numerous atmospheric and environmental changes being laid at the doorstep of climate change or global warming. Add to this the national and international challenges of the Kyoto protocol, and we have several social, economic and political issues whose relevance will become more and more compelling for the future of Canadian youth.

To answer this challenge the SEEDS Foundation is developing and implementing a climate change program for Canadian high schools. The program consists of a set of instructional resources in both languages for science, social studies, geography and environmental studies. These resources include a 54-minute video, transparencies, a teacher's resource guide, a CD-ROM and a web site.

To meet the challenge of developing and implementing a national climate change program, three things need to be addressed: the curricula, the teachers and the students. Let me begin with the curriculum.

CURRICULUM

What's Driving Climate Change Education?

Climate change is large topic with several concepts that not only include science and the environment, but also have economic, political and societal contexts. If climate change is viewed as subset of environment and development education, and sustainable development education, a call for action came in 1992 at the United Nations Conference on Environment and Development, as published in Chapter 36, Agenda 21. A number of recommendations were made including, promoting the "integration of environment and development concepts ... in all educational programmes", and "conducting a thorough review of curricula ... to ensure a multidisciplinary approach, with environment and development issues and their socio-cultural and demographic aspects and linkages." In 1995, the Council of Ministers of Education, Canada adopted the Pan-Canadian Protocol for Collaboration on School Curriculum. Subsequently, the Common Framework of Science Learning Outcomes K to 12 developed by the Council of Ministers of Education, Canada was published in 1997. One of the intents of this document was to provide curriculum developers with a common resource of learning outcomes that may result in "greater harmonization of science curriculum for increased student mobility". Similarly, a foundation document for social studies K to grade 12, called the Western Canadian Protocol was prepared in February 2000 by the four western provinces and territories. Then in 1997 the Kyoto Protocol refined the focus from what could be characterized up to then as sustainable development education to climate change education. The

Public Education and Outreach (PEO) Issue Table as part of the National Climate Change Implementation Process was formed to "build awareness and understanding among Canadians, support change, and motivate action in areas that will reduce greenhouse gas emissions." This Issue Table provided the Federal, Provincial and Territorial Ministers of Energy and the Environment with its recommended strategy on climate change public education. It seems curious that the provincial ministers of education through the Council of Ministers of Education, Canada (CMEC) were not included given the recommendation that an "education system should integrate relevant information into its curriculum." The PEO Issue Table's Final Report of November 1999, Reaching Out To Canadians On Climate Change, recommends "At the elementary and secondary level, entrenching the teaching of climate change in the school system requires an environment that supports climate change education and action. That means support for such teaching from players at all levels, from Ministers of Education, through school boards, teachers' associations, and relevant stakeholders." One would have thought that given the timing of curriculum revisions in secondary science and social studies in several provinces and territories, that the curriculum developers in the ministries of education would be involved in this outreach process. Although there are federal and provincial/territorial jurisdictional sensitivities to be considered, at the very least a representative of the CMEC should have been part of the membership of the PEO Issue Table. Presumably there's more than one way to influencing curriculum development.

Where Does Climate Change Fit In The Science, Social Studies and Geography Curricula?

For a high school climate change program to be successful, it helps if the program fits the curriculum learning outcomes. The term "curriculum fit" means that the key concepts of climate change have to be evident as specific learning outcomes in the curriculum documents. A cursory or passing mention of climate change leaves teachers with the impression that, in an already crowded curriculum, 'if you have time to deal with the topic, that's fine'. And if teachers omit climate change, it was probably because there were other topics to deal with and time was needed to satisfactorily address them. After all, if climate change concepts are really important, shouldn't they be more prominent in the curriculum?

In spite of the importance and relevance of climate change, at least if measured by the funding available from the Climate Change Action Fund (CCAF), provincial curriculum documents in science, social studies, geography and environmental studies show considerable variation in addressing this topic. Not only is it important to understand curriculum variations before developing instructional resources, it is especially important during there implementation. Specific climate change program links to curriculum learning outcomes have to be obvious to teachers, if there is an expectation that programs will be used.

To provide an approximate indication the curriculum variation and potential links to climate change, Table 1 shows the number times that reference is made to terms related to climate and weather in the grade 10 science programs in Alberta, Atlantic Canada, and Ontario. Grade 10 science was selected because it affords best fit of all the high school science courses. The list of terms could be expanded as necessary and this could also be done for other provinces and the territories. In the Alberta Science 10 Unit D: Energy Flow in Global Systems the focus is on climate. Unit D is one of four units in the course. In the Ontario science curricula there is an Earth and Space Science strand or unit that is one of four strands in each course. In the Academic Science and Applied Science the focus in these strands is on weather dynamics and weather systems, respectively. The Atlantic Canada Science 10 Earth and Space Science - Weather Dynamics is one of three units. The terms were counted in the specific learning outcomes for basic concepts, knowledge, science-technology-society-environment, and skills in these curricula. The attitude outcomes in the Alberta Science were not counted, because there is no counterpart in the Ontario Science curricula.

Although the Table 1 is an approximate word count of those terms and realising there other ways to describe climate and weather, it nevertheless gives an indication of the potential links to climate change that each science curriculum affords. Climate change program developers will of course have their own objectives for the curriculum resources they produce. However, given the variation in provincial curricula as shown in this table, it is important that developers understand the local educational milieu that presents both opportunities and constraints to the

TABLE 1. The Number of Terms Related to Weather and Climate Learning Outcomes in Grade 10 Science Curricula in Ontario and Alberta

Weather and Climate Terms in Grade 10 Science Curricula	Alberta Science	Atlantic Science	Ontario Academic Science	Ontario Applied Science
Weather	1	25	13	7
Climate	17	8		2
Climate change	8	2		
Global warming	5		1	
Greenhouse gases	4			
Greenhouse effect	1			1

Atlantic Provinces Education Federation 1998, *Atlantic Canada Science Curriculum.*
Alberta Learning, Curriculum Standards Branch 1999, *Science 10 Course Outcomes Second (validation) Draft, May 1999*, pp. 16-19.
Curriculum, Learning and Teaching Branch 1999, *Science, The Ontario Curriculum, Grades 9 and 10*, pp.21-22, 28-29.

successful implementation to their program. More will be said about implementation later.

Science and social studies together with math and English language arts (and French language arts in the bilingual provinces) are core subjects in all provinces and territories. Courses such as geography and environmental studies occur only in some provinces and territories and are often optional as opposed to core subjects. Climate change has obvious curriculum links to science courses at certain grade levels depending on the jurisdiction. Links to social studies, while not always explicit can be made implicitly in terms of the societal, economic and political issues arising from climate change. In social studies, climate change has a fit within topics such as interdependence in the global environment. Similar links can be made to geography and environmental science programs. Where climate change concepts are a part of core subjects science and social studies, it is possible to reach more students. However, it is often the case that in these core subjects learning outcomes are extensive and prescriptive thereby giving teachers little latitude to deal with topics not specifically on the curriculum. Common unit and final exams, in jurisdictions where they exist, further restrict teachers from varying from the time allotted to address the required learning outcomes and course units. It is important for developers of instructional resources to understand these issues and constraints both when developing resources and presenting teacher workshops. Even the best instructional resources may be passed over, if the teachers believe they have little or no opportunity to use them or if the workshop presenter makes no effort at understanding the local curriculum pressures facing teachers.

Tables 2 and 3 show the potential curriculum entry points for climate change in high school science and social studies, based on the current information available. At present grades 10 and 11 offer the best curriculum fit for climate change in high school science and social studies. Several curriculum revisions are underway in both these subjects and the implementation dates vary among the provinces and territories.

Table 2 shows the provincial and territorial high school science curricula by grade where climate change may have an appropriate fit. Table 3 does the same for the high school social studies and geography curricula.

It is important not to leave the impression that science, social studies, geography and environmental studies are the only subjects that climate change has a fit with the curriculum. For example, language arts, music, art, drama all have opportunities for addressing climate change and the related environmental, social, political issues involved through learning outcomes that deal with reading, writing, and creative expression. While learning outcomes

TABLE 2. **Potential Climate Topics within Provincial High School Science Curricula**

Prov./Terr.	Grade 9	Grade 10	Grade 11	Grade 12
BC			Earth Science	
AB		Global Systems Changing Earth		
SK	Atmosphere			
MB		Weather Dynamics		
ON		Weather Dynamics		
QC				
Atlantic Canada		Atmosphere	Environmental Science	
NF		Weather Dynamics	Environmental Issues	
YK			Atmospheric Science	
NT		Global Systems Changing Earth		

TABLE 3. **Potential Climate Topics within Provincial High School Social Studies and Geography Curricula**

Prov./Terr.	Grade 9	Grade 10	Grade 11	Grade 12
BC		Economy & Techn	Global Citizenship	
AB			Global Interdependence	
SK		Pol & Econ Dec Mkg		
MB	Sust Dev't 1	Sust Dev't 2	Sust Dev't 3	Sust Dev't 4
ON			Phys Geography	World Issues
QC			Phys Geography	
Atlantic Canada			Phys Geography	World Issues
NF				
YK				
NT				

specific to climate change are not likely to be found in these subjects, it is possible to address the skills using a topic that has considerable relevance and currency. For these teachers it is a matter of making them aware of climate change and the opportunities for their subjects. A number of program developers have distribution networks for both in print and electronic media. The Public Education and Outreach sector of the Climate Change Action Fund (CCAF-PEO) are planning a print tabloid and a web site that will describe the educational programs available to teachers.

TEACHERS

For many science and social studies teachers climate change is a new, relatively complex topic about which many have had little formal education. This suggests that resources should be easy to use. To address this the SEEDS Foundation is developing a video program with an interactive style that will give teachers an overview of the scope of climate change concepts and issues that can be easily presented. In addition to the video, a set of transparencies that match the graphics in the video and teacher's resource guide will provide teachers with additional background information and project suggestions that relate climate change to the curriculum learning outcomes. The video will be divided into 8 to 10-minute segments. The "interactive style" will come from our recommendation that students view a segment, and then stop the video allowing the teacher to use the transparencies and resource guide to discuss the concepts described in the video. Stopping and starting the video will allow teachers to engage their students to check and extend their understanding of the concepts presented. Discussion of a few, rather than many concepts will result in a better understanding of climate change and its complex issues. The teacher's resource guide will provide background information on the concepts presented in the video, extension activities and web site sources for additional information. It is expected that the teachers understanding of climate change will grow and if curricular or extracurricular time permits, student research and action projects will be encouraged.

A web site will provide information about climate change and facilitate the exchange of project ideas among students as well as links to other web sites. A CD-ROM will contain graphics from the video and the transparencies, black-line masters, information from the teacher's resource guide, and exercises and data to further develop students' analytical skills and understanding of climate change.

Given the number of educational resources available and the demands on teachers' time, some form implementation is necessary if the resources are to be used. Demonstrating curriculum linkages as mentioned earlier is likewise important. If linkages to knowledge learning outcomes about climate and climate change do not exist in the curriculum, then consideration should be given to the skill outcomes. If certain skill outcomes can be addressed within the context of climate change, then the understanding that students gain can be just as important as if it were part of knowledge outcomes. Such a case can be made for the aforementioned language arts and fine arts programs where teachers may have more freedom in selecting an appropriate topic to achieve the required skill outcomes.

When conference presentations and workshops are planned, consideration should be given to the audience to be targeted. When planning presentations to a specific subject audience, such as at science or social studies conferences, it is important to know the curriculum and understand any local constraints and issues that teachers may be facing. These may include: the timing of new curriculum implementation, are teachers required to teach subjects outside their present area of expertise, and is time available for upgrading and in-service? Are teachers facing school budget and teacher preparation time cutbacks? Being aware of and understanding these impediments is critical, and if the presenter is able to address them, it will do much to enhance the reception of the program implementation.

On the other hand there may be implementation opportunities. For example, at teachers' conventions where teachers from a variety of subject disciplines and grade levels are present, consideration should be given to appealing to more than one subject group. Here opportunities exist for an integrated approach to climate change. Teachers in different subject disciplines should be encouraged to plan their respect units in a cooperative way. Imagine the potential for student understanding if two or three teachers were to address the scientific, environmental, social, economic and political dimensions of climate change in an integrated manner, each contributing their individual expertise. Then if this understanding were followed by personal and collective actions at school, home and the community that reduce resource use, waste and greenhouse gases, it makes the learning real and purposeful. Nearly all climate change education programs involve action components. Some are targeted at curriculum learning outcomes and others fit into extracurricular school programs activities.

Given the number of climate change programs vying for the same curriculum space and teacher attention, it is essential to coordinate the outreach and implementation process. Several short presentations highlighting different instructional resources could be made consecutively that would give teachers an awareness of each program. Alternatively, a single presentation could describe the unique features and complementarities of several programs. Then as necessary or requested, follow-up workshops of longer duration could be offered that would provide teachers with further background in climate change and how the resources best meet their curriculum needs.

Such a cooperative process is in the planning stage among a number of developers of climate change programs and the CCAF-PEO.

STUDENTS

Moving along the continuum from awareness to understanding to action presents significant challenges. If the intent of climate change education is to move as far along the continuum as possible, then the challenge is indeed daunting. In the past, and to some extent even today, too much of the environmental topics in education have focused on the problems. Only recently are we seeing solutions and actions being proposed. We've seen over-kill on the "doom and gloom" messages and most high school students are tired of hearing them. In comparison, little attention has been paid to the solutions. Students are faced daily with conflicting messages such as the expressed concern over health effects of urban smog, loss of biodiversity and habitat, pressures of human over-population and increasing greenhouse gases set beside a concern for global competition, economic growth, unfettered consumerism common to television advertisements. Dealing with these issues is often part of the inquiry strategies seen in high school social studies courses.

The report of the International Institute for Sustainable Development, A Youth Strategy for Public Outreach on Climate Change makes several important points and recommendations. The justification for youth taking action presents a challenge because as a group their share of the greenhouse gas emissions is estimated to be only 5-6%. An educational effort that targets only youth without an equivalent or more concerted effort aimed at the adult population would be seen as hypocritical. A message to youth that says, "Please don't make our mistakes" while we carry on with business as usual would be seen for it is, an unwillingness to 'walk the talk'. There needs to be a focus on the simple, effective 'feel good' solutions, 'win-win' actions that that have environmental, societal and economic benefits. We need to showcase the large energy efficiency and greenhouse gas reduction projects that Canadians are involved in both here and abroad, while at the same time showing how the smaller, individual and collective actions have a multiplier effect that produce benefits equal to the large ones. Linking actions that reduce greenhouse gas emissions to climate change is necessary, but should be done with the understanding that tangible results of climate stabilization may be many years away. In addition to climate, links should also be made to environmental stewardship and sustainable development that are likely to show more immediate results. It is important to understand how many past environmental, societal and economic issues have come and gone from public consciousness. There may a tendency to view climate change as just another passing environmental fad. By highlighting the global context of climate change and the local, national and international efforts being applied to address the issues, it will be easier to sustain the students' and the publics' understanding of the need for action.

CONCLUSION

Using climate change as way to integrate science and social studies concepts provides a richer program than if they are taught in isolation. The relevance, currency and complexity of the issues are an advantage and yet present significant challenges. One of the most powerful motivators to learning is relevancy. When students see the knowledge, skills and attitudes of their curriculum set within a context of ecological sustainability and participatory decision-making, the real issues support the pretext that climate change should be presented in an integrated way. ❑

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Educational Outreach Approach of the Climate Change Research Center

D. Zachary Smith

Educational outreach by the Climate Change Research Center (CCRC) at the University of New Hampshire focuses on disseminating information about three scientific projects: the New England Atmospheric Investigation Regional Mapping Analysis and Prediction project (AIRMAP), the Greenland Ice Sheet Project 2 (GISP2); the United States' portion of the International Trans-Antarctic Scientific Expedition (US ITASE). We accomplish this through the use of web sites, classroom posters, school visits, CCRC facilities tours, written curricula materials, videos, and teacher workshops. The CCRC has also formed partnerships with the Boston Museum of Science, the American Museum of Natural History, and other facilities to develop and disseminate educational material.

The CCRC maintains a web site that includes information about the center, its directed projects, and links to other related sites. Recently, a new interactive web site for the US ITASE expedition was created and maintained by the CCRC and the Boston Museum of Science. Posters and written curricula have been produced to translate information from scientific expeditions for use in classrooms. These materials are distributed during school visits, on the web sites, and at teacher workshops. CCRC staff routinely present to local school students, public groups, and at educational conferences. Presentations focus on climate, climate change, and recent ice coring expeditions. Each year teacher workshops are presented by the CCRC, often in cooperation with other educational groups. Workshop teachers are given information on the center's programs and are also provided with written material (such as posters, information booklets, and lab exercises) which they can take back and integrate into their curriculum.

OUTREACH METHODOLOGIES

The goal of the educational outreach program at the Climate Change Research Center (CCRC) is to educate students and the public about climate change. To accomplish this goal, the outreach program focuses on disseminating information about the CCRC's scientific projects: the New England Atmospheric Investigation Regional Mapping Analysis and Prediction project (AIRMAP), the Greenland Ice Sheet Project 2 (GISP2); and the United States' portion of the International Trans-Antarctic Scientific Expedition (US ITASE). This is done through the use of web sites, posters, school visits, CCRC facilities tours, written curricula materials, and teacher workshops. These educational materials translate scientific information from our research for use in the educational outreach program. Much of the outreach efforts are accomplished through liaisons set up between the CCRC, the Boston Museum of Science, the Wright Center for Science Education at Tufts University, the Rythmics Sonifications Laboratory, the United States Cold Regions Research and Engineering Laboratory and numerous other institutes and agencies.

The educational materials developed correspond to both the state of New Hampshire Science Standards and the National Science Standards. The use of standards-based materials stems from the growing need by educators around the country for science curriculum guidelines. Student laboratory exercises, that follow the state and national standards, have been written based on actual polar research experiments done on GISP2 and US ITASE. These laboratory exercises include topics such as measurement of permeability and porosity of snow, albedo, varved sediments, and glacier flow modeling. The GISP2 Climate Card, constructed from actual GISP2 data, also uses science standards-based student follow-up questions.

Introduction to the Climate Change Research Center (CCRC) (http://breeze.sr.unh.edu/ccrc/)

The Climate Change Research Center (CCRC) at the University of New Hampshire is directed by Dr. Paul Mayewski and focuses on investigating temporal and spatial changes in the Earth's paleoclimate. This is accomplished through the retrieval and analysis of global change records collected from around the world. These records document climate (response and forcing), biochemical cycling, atmospheric chemistry, unique atmospheric phenomena (e.g. extreme events, volcanic events, biomass burning), and the impact of anthropogenic influences on our environment. The center is directing a series of field and laboratory programs from atmospherically teleconnected high latitude sites (e.g. Antarctica, Greenland, and the Canadian Arctic) and low to mid-latitude sites (e.g. Asia and North America) in order to investigate a variety of global change problems. Climate Change Research Center personnel develop solutions to global geoscience problems through multi-disciplinary efforts involving mathematical modelers, atmospheric chemists, geochemists, biogeochemists, statisticians, oceanographers, anthropologists, and physicists.

Introduction to the Atmospheric Investigation Regional Mapping and Prediction project (AIRMAP), the Greenland Ice Sheet Project 2 (GISP2), and the United States International Trans-Antarctic Scientific Expedition (US ITASE)

Educational outreach by the Climate Change Research Center (CCRC) at the University of New Hampshire focuses on disseminating information about three scientific projects: the New England Atmospheric Investigation Regional Mapping Analysis and Prediction project (AIRMAP); the Greenland Ice Sheet Project 2 (GISP2); and the United States' portion of the International Trans-Antarctic Scientific Expedition (US ITASE). These scientific projects are only a few of the on-going projects at the CCRC, and they each contribute to the understanding of a different aspect of climate change science. The projects involve: atmospheric chemistry monitoring over New England which contributes to the analysis of current atmospheric conditions in industrialized America; retrival, analysis, and examination of a 110,000 year record of the paleoclimate from Greenland which contributes to the analysis of global paleoclimate; and retrival, analysis, and examination of the atmospheric conditions in Antarctica during the past few hundred years which contributes to a high resolution analysis of global climate change. Before students can begin to understand what natural and artificial climate changes take place on the Earth, they need to be aware of current and paleoclimate changes. These CCRC projects provide background information and a practical context for assisting in that understanding of climate change by students.

The Atmospheric Investigation Regional Mapping and Prediction project (http://www.neci.sr.unh.edu/)

The goals of AIRMAP are to synthesize data, generate information, and communicate relevant research results concerning variability and uncertainty in the physical and chemical climate regimes in New England in order to meet the specific needs of policy makers, stakeholders, and the public through the New England regional assessment. Two key climate-society issues in New England that can be addressed with the products of AIRMAP research are the connection of tropospheric ozone to human and ecosystem health, and extreme weather events and their emergency management. Data is collected through monitoring stations positioned throughout New Hampshire. New England's air quality has experienced dramatic changes over the past several decades as a result of pollution derived from industrial emissions and the burning of fossil fuels from upwind sources and from within the region. The state of New England's air quality has a significant effect on human and ecosystem health and on quality of life. Issues of concern include: high levels of ground ozone, acid rain, increased airborne particulate matter, and the build-up of pollution during the week which results in increased rainfall on the weekends. This program, in cooperation with Plymouth State College, the Mount Washington Observatory, the National Oceanographic and Atmospheric Administration's (NOAA) Forecast Systems Laboratory, and NOAA's Air Resource Laboratory has established several atmospheric monitoring stations in New Hampshire. Though only in its first year, AIRMAP has deployed automatic collection systems in four locations in New Hampshire. These monitoring stations take atmospheric samples that are later analyzed in the laboratory. Since most major atmospheric circulation systems in the United States converge over New England, the location of the AIRMAP monitoring stations is important to fully understanding the movement and concentration of atmospheric chemicals.

The outreach and broad educational value of AIRMAP lies in its analysis and communication of air quality data that can be easily interpreted by students. This knowledge helps in the understanding of the variability of air quality and its direct effects on human and the environment.

The Greenland Ice Sheet Project 2 (GISP2)
(http://www.gisp2.sr.unh.edu/GISP2/)
The Greenland Ice Sheet Project 2 (GISP2), which completed drilling in 1993, successfully collected an ice core from the summit of the Greenland Ice Sheet 3,053 meters to the bedrock below. This ice core was dated annually back to 110,000 years before present (ybp) (though its bottom age approaches ~250,000 ybp) and is the most complete, most detailed record of the Earth's paleo-environment available. Eighteen different American institutions participated in the GISP2 project and analyzed the ice core for a variety of parameters including; oxygen isotope 18 and 16 ratio (proxy for temperature), aerosol content, gas content, and cosmogenic isotopes. From these measurements, a paleoclimate record of Greenland was interpreted. The GISP2 ice core data helped scientists understand the rate and amount of change in temperature that has occurred back to the last interglacial period. In the past it was believed that climate changed gradually and slowly, but GISP2 data demonstrated that many Rapid Change Climate Effects (RCCE) have occurred throughout the last glacial period, from ~10,000 ybp to ~110,000 ybp. These Rapid Change Climate Effects displayed temperature changes of up to 15 oC (in Greenland) in less than a few years. The GISP2 data also confirmed the existence of the Younger Dryas Event (YDE) which was a return to glacial conditions ~12,900 ybp to 11,500 ybp whose cause is still under investigation.

The outreach and broad educational value of the GISP2 data lies in its display of naturally occurring dramatic climate change throughout the last glacial period. This knowledge also helps in the interpretation of climate forcing mechanisms, the causes of anthropogenic- forced climate change, and changes in atmospheric chemistry.

United States International Trans-Antarctic Scientific Expedition (US ITASE) (http://www.antcrc.utas.edu.au/scar/itase/toc.html) (http://www.secretsoftheice.org)
The United States component of the International Trans-Antarctic Scientific Expedition (US ITASE), which had its first field season in 1999 and will continue through 2003, is a new multi-disciplinary program designed to gain a better understanding of the temporal and spatial variability of Antarctica's climate. Programs from fifteen member nations, including US ITASE, are cooperating in the ITASE project that will drill <50 meter deep (with some >100 meter deep) ice cores throughout Antarctica. Antarctica is larger than the continental United States and very little is known about its climate variability. The focus of US ITASE is to obtain snow and ice samples from sites in West Antarctica which will display the past >200 years of Antarctica's climate history. This time period corresponds to the human industrial revolution and will aid in understanding the effects of anthropogenically-introduced atmospheric chemicals. The US ITASE project, directed by the CCRC, includes researchers from seven American institutes. US ITASE research employs cutting edge technology in the fields of Global Positioning Satellite system (GPS), ground penetrating radar, ice core drilling, Antarctic expedition deployment, and satellite communications using Iridium satellite phones. During its first field season US ITASE drilled a total of 175 meters of ice and collected hundreds of snow samples. Numerous successes were recorded during this first shake-down season from October 1999 to December 1999, which included the identification of continuous deep (15-60 meter) firn and ice layers that spanned the entire 180 kilometer (km) traverse route. Each successive year US ITASE will follow a different traverse route and collect additional snow and ice samples to analyze for chemical and physical climate indicators. By the end of the fourth year US ITASE will finish at South Pole Station.

The outreach goals of US ITASE include: direct contact with students through daily log updates on the web page (while the program is deployed in Antarctica), offering students and teachers laboratory exercises that are pertinent to US ITASE research; an opportunity for students to ask questions of US ITASE scientists; and providing periodic teacher workshops on climate change. This knowledge also helps students understand about Antarctica, global climate change, and human impacts on remote areas.

EDUCATIONAL MATERIALS

New educational materials have been developed based on research topics associated with CCRC projects. Many of these materials are unique to this outreach effort. These materials include: web sites, classroom posters, school visits, CCRC facilities tours, written materials, videos, and teacher workshops.

Web Sites

The CCRC maintains two web pages, one provides information about the department (http://breeze.sr.unh.edu/ccrc/) and another, in collaboration with the Boston Museum of Science, focuses on the US ITASE project (http://www.secretsoftheice.org/). One web page provides information about the department and many of its current projects (including the aforementioned three projects and their respective web sites), data sets from the research projects, abstracts from professional papers, and links to other pertinent web pages. This web page is useful for audiences that have a general understanding of climate change and can utilize data sets. The text and pictures offer a basic introduction to climate science and the data sets offer a rarely offered opportunity for students to graph and interpret real data. Students can then develop their own ideas about climate change from the data sets. >From this web page browsers can access the full text of the Greenland Ice Sheet Project 2 Notebooks, as well as a list of GISP2 principle investigators with links to their home sites. Pictures from Greenland, Asia, and Antarctica, the New England Climate Change Initiative (now AIRMAP), and other CCRC programs are also available on the web page.

The US ITASE web page (http://www.secretsoftheice.org), in cooperation with the Boston Museum of Science, offers an array of links that provide background information about Antarctica and an interactive section that directly links the public with the scientists in Antarctica. The interactive section has three parts: a question/answer section where people can ask questions directly of the scientists in Antarctica; a section with daily updates from the field team; and an archive of the live phone calls made from the field team in Antarctica to the Boston Museum of Science. Daily communiqués from the team in Antarctica focus on both current weather information and the daily work of the team. Since an important aspect of the expedition is to collect ice cores, a log of the total amount of ice core drilled was also recorded. Through this section people worldwide can stay abreast of developments with the team as they travel across Antarctica collecting ice and snow samples. This segment is also highlighted by digital images sent through the Internet by the team in New Zealand and McMurdo Station, Antarctica. The Boston Museum of Science maintains a current display for the US ITASE expedition and provides the facilities for the public to listen to the live phone conversations from Antarctica. As data is analyzed, appropriate findings of the last US ITASE expeditions will also be posted. This web site includes activities for students to "dress the scientists" and investigate relationships of paleoclimate records collected on GISP2 (GISP2 Climate Card).

Classroom Posters

For each of the three scientific projects, high school/middle school-appropriate posters have been developed. These posters contain vivid photos and diagrams along with written descriptions that explain each project and the components of each project. The posters, approximately 24" x 30", are designed to be hung in middle school and high school classrooms and serve as a graphic reference for each project and a stimuli for generating student questions. Each poster also contains the project's web site and the list of participating institutions involved in each project. This is considered an important section of each poster and helps students obtain further information about each project as well as providing an understanding of the extent of collaboration in current scientific projects. The posters are given out free at school presentations and teacher workshops. Money to produce the posters was provided through the CCRC departmental budget. Future plans include production of a larger number of posters for distribution to more classrooms.

School Visits

During the spring of 2000, presentations at over two dozen school were given on the GISP2 and US ITASE projects. Classroom presentations were made to students in grades kindergarten through 12th grade. Before each presentation, teachers were supplied with grade-appropriate outlines for the presentation with the flexibility to adapt to each classroom's specific requirements. Presentations focused on the remoteness and extreme environment of Antarctica for younger grades to the interpretation of data and the sensitivity of Antarctic climate for older students. Important scientific concepts, such as age/depth relationship that corresponds to the Law of Superposition, were introduced at age-appropriate levels. Each teacher was also supplied with all available CCRC educational materials and recommendations were made for follow-up activities with the students after the presentations. Follow-up activities often took the form of classes writing their own "books" on Antarctica, in a form similar to that of Aurora Australis, the book published by Ernest Shackelton and his men on the 1907-1909 British Antarctic Expedition. For Aurora Australis, Shackelton and his men wrote short stories and poetry and produced lithograph illustrations about their time in Antarctica. The books produced by students typically remain in the classroom for reference by the students.

Climate Change Research Center Facilities Tours

The facilities of the CCRC are always open by appointment for tours. Within the department facility are wall displays that describe the GISP2 project in detail. The department is also part of the National Ice Core Repository and houses ice cores from all of the CCRC ice coring projects including Asia, Antarctica, and the Arctic. Tour participants are taken through the ice core storage freezer, the ice core processing rooms, and the ion chromatography laboratory. The complete tour, including a brief introduction, takes only about 35 minutes but gives participants a complete view of the process of collecting ice cores from remote areas, transferring them to the storage facility, and then processing them to the final stage of data analysis. In cooperation with other scientists from the Earth, Oceans, and Space Institute at the University of New Hampshire, tours have been given for groups as large as 80 students.

Written Materials

The written materials that have been developed are in three forms, background information booklets, classroom laboratory exercises, and the GISP2 Climate Card. Among the booklets that have been produced are one for the AIRMAP (formerly NECI) project which explains air quality monitoring and analysis, and one for the Ice Core Working Group which explains ice coring and analysis. Another product, titled Glacier, Climate, and the Landscape, is an educator's guide to glacial geology and glacial morphology land features.

Eighteen classroom laboratory exercises have also been produced that are in different states of classroom testing. The classroom exercises are written largely for grades 5 through 12 and have a focus on polar science. Many of the exercises are original and closely follow experiments done by scientists on polar expeditions. The exercises are written for teachers that would like their students to perform laboratory experiments and demonstrations that allow them to understand important scientific concepts typical in polar studies. The concepts include; albedo, angle of incidence, porosity and permeability, depth to age relationship, and the structure and development of glacial morphological features. These laboratory exercises are available to teachers of any grade level but are geared at a language and ability appropriate for 8th and 9th grade students. The laboratory exercises are standards-based, hands-on, multi-stepped, and typically require students to quantify and graph their results. Each laboratory exercise takes one to two class periods to perform. Background information, valuable resources, and a reference to specific scientists and their polar research projects are supplied with each exercise. Also being developed for each of these exercises is a photo essay or video that records real scientists performing the laboratory exercises. This photo record will assist teachers and students as they perform the laboratory exercise in their classrooms, and it will help them gain insight into how real scientists perform actual experiments.

The GISP2 Climate Card is a manipulative set of overlay graphs plotted from GISP2 data sets. The GISP2 Climate Card, available on the web at **http://www.secretsoftheice.org** (click on "educational resources", click on "interpreting ice core data"), displays graphed data from the GISP2 ice coring project. The GISP2 Climate Card allows students to use real data to compare the graphs for the temperature in Greenland to those mechanisms that may have forced climate change in Greenland and worldwide. These graphs allow comparison of the temperature in Greenland over the past forty thousand years (provided by temperature proxy data from oxygen 018/016 ratios), to three type of climate forcing mechanisms; atmospheric greenhouse gas (provided by methane data), atmospheric aerosol data (provided by calcium data), and insolation data. This gives students an understanding of the amount and rates of paleoclimate change interpreted from the GISP2 ice cores. Within the displayed data of the GISP2 Climate Card are also Rapid Change Climate Events (great intensity and short duration climate changes) and the Youger Dryas Event (return to glacial conditions between 12,900 ybp and 11,500 ybp). Also available with the GISP2 Climate Card is a curriculum guide, a teacher's guide to information about the GISP2 project and its data sets, a set of standards-based investigation questions, and a set of instructions for use with the GISP2 Climate Card. The GISP2 Climate Card was first produced in a hard copy format but has recently been added to the US ITASE web site. This use of data is enhanced because of the ease of operation on the web site.

Videos

A 30-minute video has been produced on the GISP2 project. Most of the footage in the video was taken on location at Summit, Greenland during the drilling of the GISP2 ice core. This video is an excellent source of background information about ice core drilling projects and the GISP2 project. The video was produced by an outside company in cooperation with the CCRC. This video is available through the CCRC or the production company. Future plans are underway to produce a video for the US ITASE project. The US ITASE video will be produced from footage shot in Antarctica on the US ITASE project on each of the four traverse routes in 1999, 2000, 2001, 2002.

Teacher Workshops

Teacher workshops for both the GISP2 project and the US ITASE project were held in the last twelve months. Both workshops were one day long and were held at the CCRC facilities at the University of New Hampshire. Each provided teachers background and experience with the scientific project and supplied a full assortment of educational materials to take back to their classrooms. Workshops are advertised locally through the Hew Hampshire Science Teacher Association newsletter, local teacher list serves, and the Boston Museum of Science web site. Members from the GISP2 team also presented to teachers at a three-day summer workshop sponsored by the Wright Center for Innovative Science Education at Tufts University, Medford, Massachusetts. Teacher presentations were also given at the New Hampshire Science Teacher Conference in the fall of1999. Tours of the facilities at the CCRC were given to groups of students and/or teachers upon request. The tours involved short presentations on background information concerning the facility, explanations of each scientific project, a look inside the ice core storage facility where ice core samples are stored, a view of the ice core cutting room, and a chance to see the ion chromatograph chemical analysis laboratory.

On July 25th, 2000 a three-day teacher workshop, "Studying Climate Change in the Classroom", will be held in Wolfeboro New Hampshire. This workshop is co-sponsored by the Climate Change Research Center and the Wright Center for Innovative Science Education at Tufts University. It has already been filled at twenty-five teacher participants from five countries and twelve US states. The three-day event will involve the presentation of CCRC-developed materials, a look at current earth science teacher/student programs, participation in interactive laboratory exercises, and attending presentations by other peer teachers. Sessions will be presented by Dr. Paul Mayewski (director of the CCRC), Dr. Barry Keim (NH state climatologist), Dr Stephanie Shipp (co-PI of Teacher Experience in Antarctca), Dr. Jack Ridge (Tufts University geologist), Dr. L. David Meeker (University of New Hampshire), and area high school teachers. Full-time educators that work with students in grades 6th and up were eligible to apply. This workshop is free to participants.

PROGRAM ASSESSMENT

Assessment of the outreach program at the Climate Change Research Center is conducted by monitoring the continued number of responses that we have received from teachers for information, live presentations, and written materials. Our last one-day teacher workshop was very well attended and was filled at 25 participants. Since the finish of the ITASE 1999-2000 field season, we have presented at sixteen schools and handed out dozens of copies of written material. For the next field season of US ITASE, a number of teachers have been selected to participate in a study of the effectiveness of the US ITASE outreach program. These classes range from grades K-12th and are located throughout the United States, Europe, and New Zealand. Each teacher has agreed to follow the US ITASE expedition on the web site during the field season, utilize CCRC educational materials, and have their students interact with the scientists during the expedition. These teachers have also agreed to complete written evaluations of the effectiveness of the outreach program. This will create a more comprehensive and detailed analysis of the outreach program and enable the outreach coordinator to modify the program as determined suitable by this assessment.

CONCLUSION

With public interest directed at global climate change and diminishing air quality, there is a definite need for standards-based, real-time, interactive, student outreach programs. Through the use of the AIRMAP, GISP2, and US ITASE programs, the interactive web site, and the companion classroom-appropriate materials, the Climate Change Research Center's outreach program has been able to make a positive impact on students and their teachers. Plans have also been initiated to host multi-day science workshops for school districts in some states. Continued curricular materials and web site development, teacher/student workshops, and international partnerships are also planned. ❑

ACKNOWLEDGEMENTS

The emphasis on public outreach at the Climate Change Research Center (CCRC), including the establishment of a full-time educational outreach position, are the result of the director, Dr. Paul Mayewski's, desire to make the research more accessible to the public. The team at the CCRC is staffed by extremely competent and helpful individuals who have all contributed to the work of the educational outreach coordinator and outreach as a whole. Without the efforts of Dr. Paul Mayewski, Mr. Mark Twickler the CCRC's associate director, and the many scientists and graduate students, educational outreach at the CCRC would be impossible.

Postnote

After August of 2000, the ice coring and analysis section, along with the outreach component of the Climate Change Research Center, will be relocated to the Climate Studies Center at the Institute for Quaternary Studies, University of Maine, Orono, Maine. Outreach cooperation with the Boston Museum of Science, the Wright Center for Science Education at Tufts University, the Rythmics Sonifications Laboratory, the United States Cold Regions Research and Engineering Laboratory, and other organizations will continue. Further information about the educational program products and activities can be obtained through Zach Smith, at the Climate Change Research Center at the University of New Hampshire, Durham New Hampshire zach.smith@unh.edu until July 1, 2000 and at the Climate Studies Center, Institute for Quaternary Studies, University of Maine, Orono Maine after July 1, 2000.

Session E1

VALUES AND RESPONSIBILITY

Signal to Noise: Listening For Democracy and Environment in Climate Change Discourse
Leigh Glover
University of Delaware

From Global Framing to Local Action: Translation of Climate Change Impacts in Africa
O.A. Ogunseitan
Harvard University

Who are Our Neighbours? Personal Automobile Choice, Climate Change and Ethics
Paul A. Kay
University of Waterloo

Theological and Ethical Dimensions of Addressing Climate Change: Reflections from the World Council of Churches (WCC)
David G. Hallman
World Council of Churches Climate Change Programme

Signal to Noise: Listening For Democracy and Environment in Climate Change Discourse

Leigh Glover

Failures in national climate change policy in the U.S.A., Australia, and other developed countries have been manifested by poor responses in reducing greenhouse gas emissions since 1992. Communication inadequacies between governments and the general public have been wrongly identified as a major cause of these failures. National policy formulation processes have been characterised by minimal community input and a poverty of discourse over the ethical and practical implications of ecological justice. Effective longer-term policy formulation needs to engage civic society and consider ecological justice to overcome the limitations currently imposed by liberal-democratic nation states and ecological modernisation policy approaches.

INTRODUCTION

Stating that climate change policy is dependent on engaging communities and corporate interests(and that assessing its effectiveness is possible by measuring resultant changes in the behavior of these groups(is unlikely to excite controversy. Failures to produce effective climate change policy outcomes are, therefore, partly or wholly the result of failing to engage these groups. Such a dilemma seemingly has its roots in the failure of national government to communicate with the governed. Yet how unassailable or complete is such reasoning? Rarely are climate change policy failures attributed to the efficient functioning of the market economy within the liberal democracies of the developed nations. In this paper we explore the implications of these contrasting propositions and consider ways in which a different and more effective policy discourse might be constructed.

Developed nations identified as 'Annex I nations' under the UN Framework Convention on Climate Change (FCCC) (UN 1999) are the focus of this paper, but with particular attention given to the U.S.A. and Australia (1). Of those various elements comprising climate change policy, greenhouse gas emissions mitigation receives the greatest attention and is the focus of discussion here, particularly policies directed at the public. However, many of the conclusions drawn may also apply equally well to future impacts and adaptation policy formulation, which to date has been largely research oriented.

NATIONAL EMISSIONS REDUCTION PERFORMANCE: STRIVING FOR THE INADEQUATE

Despite the successes of many individual programs and activities to reduce emissions (e.g. see USDOS 1995), national performance is what counts under the FCCC. On the basis of the attempted greenhouse gas reductions by Annex I nations in the first reporting period under the FCCC (and prior to the Kyoto Protocol), climate change policy was generally a failure. Few developed nations managed to return annual emissions to anything close to that of 1990, the original FCCC target (UN FCCCS 1999). Most nations, in fact, increased their emissions between signing the FCCC (which began in June 1992) and signing the Kyoto Protocol (opened for signature in March 1998) (UN FCCCS 1999). And the immediate future may not be much better. Despite having 8 to 12 years to achieve the (nationally differentiated) Kyoto Protocol targets, on the basis of current efforts there are reasonable grounds to anticipate further disappointments between 2008-2012, at least for the U.S.A. (USDOE 1999, USEIA 1999), while Australia's prospects are ambivalent at this time (Australia 1997, 1999).

Poor national performances in reducing emissions appear, however, not the result of inadequate knowledge of emissions reduction or operating the energy system more efficiently, for the research effort extends over at least the last two decades and runs to thousands of published items. Taking the United States as an example, there are a number of recent studies describing the ways in which greenhouse gas emissions can be reduced cheaply and effectively across the economy (e.g. IWG 1997, Union of Concerned Scientists and Tellus Institute 1998). Australia, similarly, has an extensive research base for emissions reduction and energy system reform (e.g. Dovers 1994, Rossiter and Lambert 1998).

Nor can the continuance of high greenhouse gas emissions be attributed to the absence of known policy options for reaching the Kyoto Protocol targets. National and state governments, policy advocates, and international groups have all produced policy materials. Policies and studies of energy/ greenhouse gas issues exist for Annex I nations (IEA 1994, IPCC 1996a) and exhibit a high degree of commonality in many proposed measures. For example, the U.S. "National Climate Change Action Plan" outlines a set of policies for national emissions reduction (Clinton and Gore 1993, Clinton 1997), as does Australia's "National Greenhouse Strategy" (Australia 1992, 1998). Flavin and Dunn speculated: "Indeed, if all nations had by now adopted the most effective policies already taken up piecemeal by one or more countries, global greenhouse gas emissions might well now be headed down." (1998:114).

Perhaps most surprising is that we cannot claim complete public disinterest – in fact, the opposite appears true. Public opinion has exhibited concern over climate change, at least as suggested by opinion polling results in the U.S.A., Australia, and elsewhere. Attitudes, of course, do not translate directly into behaviour.

Although the greatest administrative and scholastic attention is given to national policies, sub-national policy initiatives are probably just as important - for it at these scales where much of the individual decisions affecting emissions actually occur. Policy-makers are beginning to turn their attention to states, cities, and smaller regions. 'Cities for Climate Protection', an International Council for Local Environmental Initiatives program, is one such encouraging activity. In the U.S.A., the State and Local Climate Change Program, under the Environment Protection Agency (USEPA 1998), has supported state policy formulation and is another important program.

Performance at the local and regional scales appears mixed, but there have been a number of highly successful programs and individual initiatives. Overall, the coverage of these policies at the sub-national level is uneven, as is the breadth of issues encompassed and specificity of policy measures. Typically, these policies operate in isolation, with little coordination between policies and activities in differing sub-national jurisdictions. Consequently, local successes rarely turn into national lessons and so do not influence overall national performance significantly. Furthermore, uneven performance at these finer scales seems partially attributable to the coordination and implementation problems that plague national policies.

A rationalist's approach to these circumstances of ineffective policy delivery leads to examining the reasons why the subjects of the policyæthe community at largeæare responding so weakly to the policy messages. Conversely, communities are seemingly demanding little of their governments in reaction to the climate change issue. Rational inquiry, in this sense, seeks to identify the need for changes in behaviour, the appropriate sources of information, and policy instruments to justify, direct, and achieve social change.

POLICY DEAFNESS?
INTERPRETING COMMUNITY INACTION AS A COMMUNICATION PROBLEM

Policy-makers have identified a number of reasons to explain the absence of uniformly effective community responses to climate change policies and these 'barriers' involve communication issues. Much of the following is drawn from discussions with those involved in climate change policy over several years. As such, these concepts represent a mix of the political, economic, administrative, and the pragmatic.

Confidence that the community comprehend the scientific basis of the issue appears low amongst those involved with climate change policy. Climate change science is complex and involves a distant causal link between an individual's and family's actions and the future global ecological consequences. Environmental problems can often only be understood and managed through science as mediated by experts (Beck 1995), and climate change readily exemplifies this problem.

Translating this specialized knowledge into a language and form accessible to the community becomes as essential as it is difficult. Scientific uncertainties and public controversies brought forward by vested commercial interests may have undermined community willingness 'to take climate change seriously'. Energy industry solidarity of opposition has become problematic in recent years, even among the oil and coal corporations, as evidenced by the membership of the Pew Center on Climate Change. However, the effects of industry campaigns over the legitimacy of climate change science and to question the necessity of policy initiatives may linger. In short, many in the policy community believe the general community simply does not understand the issue sufficiently well to respond to existing policies or to take individual initiatives.

An expression of this policy-maker's perception lies close at hand. Did not the survey accompanying this Conference ask: "Climate change is a difficult issue to communicate to the public. What specific information needs to be communicated to inform the public about climate change and its implications?" Approaches such as this seem premised on assumptions about learning, a hierarchy of authentic knowledge, and uniformity of public values, needs, and expectations. Particularly telling of the confidence in the existing polity to resolve complex environmental problems is the overriding assumption that our current policy formulation process is capable of resolving this question.

Overlapping with the issues of public perception of knowledge are explanations focusing on the politically contested character of the climate change, which hold that the formation of broad community consensus is currently impossible. Annex I nations have acknowledged the seriousness of the climate change issue, but the level of rhetorical concern has been rarely matched by corresponding levels of compulsory and enforceable climate change policy (hence the popularity of 'no regrets' measures).

Relevance is often described as a crucial factor for effective policy: for most of the community there is no apparent immediate link between climate change and daily life. As the impacts of climate change will be realized in the future and because of the wide variation in vulnerability and impacts across space, the public may discount the need for immediate action on their part. Science can offer little specific guidance as to the extent and location of the potential impacts at the local scale, although the vulnerability of some land uses, general locations, and economic activities has been established (IPCC 1996b).

Despite the anecdotal character of the aforesaid claims, they appear widely held within the broader climate change community, at least in the U.S.A. and Australia. Combined, these factors are considered metaphorically as constituting the reason why the climate change issue hasn't crossed the 'threshold' of public concern that would resulted in concerted action. It is reasonable to consider that at least some of these factors have shaped public responses to climate change policy, if only because policy-makers believe them to be true.

REPACKAGING POLICY AS PRODUCT

'Solutions' emerge freely from the articulation of the problem as one constituting communication barriers between government and general populace. Governments are urged to 'deliver a clear message through effective communication', 'provide public incentives', and promote 'an understanding of the consequences of inaction'. Indeed, climate change policy discourse is replete with such phrases and sentiments. Largely, the emphasis is on refining the message and improving its public reception; businesses and environmental groups concerned over the slow pace of reform have openly sought to support and supplement such activity.

Rather than confronting those cultural arrangements that encourage greenhouse gas releases, policy-makers have moved to improve the prospects of success by considering the citizen as a consumer of a product called 'policy'.

Techniques of commerce are also employed for the non-economic policy 'products'. Polling assesses community attitudes in order to improve the effectiveness of policy 'marketing'. Discrete community segments are identified in order to customize the messages for each. Advertising and promotion are employed in broadcast and direct media campaigns, wherein policy-makers work closely with public relations and communication companies. In these approaches, a wide range of experts and professionals are brought forward to advise on effective means to reach the community.

Climate change policy has coincided with an era when western governments have taken up market-based policy instruments, and policy-makers at the international and national level have evoked the use of economic tools as additional policy initiatives. Communication of the climate change message can be achieved, argue economic rationalists, by creating appropriate markets and enabling the price mechanism to reflect the social allocation of value in manner more effective than government 'command and control' approaches.

However, regulatory measures have not been prominent in climate change policies, especially so in the U.S.A. and Australia. Correspondingly, the failures to reduce emissions are commonly attributed by market rationalists to the policy implementation processes for measures that, in the cases of the U.S. and Australia, are largely voluntary. Many of these critiques seeking to promote market-based policies have given little attention to differentiating between success and failure in specific programs. Brunner and Klein (1999) are highly critical of such approaches and their assessment of the U.S. "Climate Change Action Plan" seeks to analyse the reasons for particular program results, and identifies many policy victories.

Improving policy implementation through enhanced communication may well assist in removing genuine impediments between climate change policies and a potentially responsive public. And while such approaches might at least partly dispel any notions that the public is confused, apathetic, ignorant, and possibly hostile in its regard of climate change policy, the basic rationale of policy formulation remains firmly in place, as do the fundamental impediments to effective social change.

LISTENING FOR DEMOCRACY

Few revelations could be less surprising than learning that bureaucrats and administrators consider policy rationally, administratively, and respond to those inputs representing the exercise of economic power. Yet within this policy system operate a set of assumptions concerning the functions of communication and roles of policy actors. Seeking to resolve the problem of climate change as a managerial issue has seen Annex I governments involved in ecological modernisation, using administrative rationality, with elements of economic rationality being brought increasingly into play and with a policy discourse dominated by science, business, and government. Such approaches rely on expertise, rational problem-solving techniques, specialist agencies or groups, and a tendency to apply regulatory or voluntary policy tools (see Hajer 1995). Accordingly, governments assume centre stage as they determine the public interest, set policy goals, and assume responsibility for environmental management.

What has brought administratively rational models of governance into question in liberal democratic states in general has been their policy performance: Weale (1992) called this phenomenon an "implementation deficit". Christoff's assessment of Australian greenhouse policy exemplifies this critique; the policy had "... been thwarted by a lack of political support for energy conservation and by a concerted programme of expansion in greenhouse-damaging activities ..." (1998:120).

Dryzek (1987, 1997) and Beck (1992) provide an account of the general failures of administrative rationality for environmental policy, which include that environmental issues often don't readily fit bureaucratic organisational structures and that environmental reform can be stifled by the increasing costs of greater levels of environmental protection. Germane to climate change policy, they also state that relevant knowledge can exist beyond that known by the 'experts' and that government agencies struggle to ensure compliance with established policies by the public, corporations, and other policy 'subjects'.

Administrative approaches also have limited capacity to counter vested interests, especially when these derive from sources of economic wealth and power. National governments have usually framed their policy responses with a view to reducing the potential economic losses resulting from climate change policy, rather than minimising those losses from potential climate change impacts (e.g. Brunner and Klein 1999, Christoff 1998). Corporations with a commercial aversion to climate change policies have also worked to prevent effective policy formulation at the national and international levels (e.g. Beder 1997, Gelbspan 1997), such as resisting the imposition of carbon taxes (e.g. Paarlberg 1999, Passacantando 1999). Indeed, of such designs to countervail any public response, Gelbspan (1997:5) stated: "*The reason most Americans don't know what is happening to the climate is that the oil and coal industries have spent millions of dollars to persuade them that global warming isn't happening.*" In this manner, the capitalist dimension within liberal-democratic governance works against the realisation of climate change policy goals deemed contrary to the interests of economic enterprises (Byrne and Yun 1999).

Liberal democratic systems contain many institutions and practices whose function is to realise some version of the democratic ideal, such as elections, party systems, access to information, use of non-government decision-making groups (e.g. inquiries, appointed boards), and public consultation. While policy-makers have invested taxpayer funds in consultant's efforts to analyse public opinion, there have been relatively few attempts to establish any fora or institutional arrangements through which to consult with the community or to enable citizen participation in policy formulation. It is clear that the bulk of policy formulation is not overtly democratic, but principally administrative. Knowledge created under these circumstances becomes privileged, while relevant community knowledge is assumed not to exist.

Of all the influential policy actors involved in national climate change policy, the broader community itself has typically not been involved to any significant degree, although there have been some consultative efforts at the state and local level. Of the 18 U.S. states having completed climate change plans, 11 used stakeholder groups, with 7 having some form of community involvement in the planning process (Clouse 2000). National climate change policy has arguably been partially shaped through the input of community-based NGO lobbying efforts - but such instances of associative democratic action seem marginal. Accordingly, climate change policy has not engaged civil society in any consistent or meaningful way. Communication has come to mean improving the government's ability to speak to the public, rather than its attempting to listen or discuss.

Questioning the ecological modernisation policy formulation approach (with its attendant hierarchical, technocratic, and administrative characteristics) may, paradoxically, offer a means by which more effective climate change policy can be generated within the prevailing cultural, economic, and political circumstances. Democratisation of the issue may also offer a means by which climate change policy could challenge the prevailing cultural habits of developed nations, characterised by high resources and energy consumption, the abundance of consumer goods and services, high environmental costs, and the commitment to economic growth.

Benefits from involving the public in policy formulation take various forms. Given the low public reception to climate change policy messages, policy-makers appear less than perfectly informed of public values and knowledge. Within the community are values and interests that are not expressed when governments refer only to experts, government officials, and business, so that policies derived from public involvement may be more effective. One critical issue is that of the understanding of risk, given that the rationale for the FCCC is the threats to human and natural systems from climate change. Public perceptions of risk often differ from those derived from scientific discourse (Beck 1992, 1995), a theme little explored by climate change policy-makers.

Fiorino (1996) argues that the loss of confidence in major institutions is partly the result of the inability of the community to participate in public decision-making. Participation can, therefore, make government decisions more legitimate. In this sense, the quest for civil society engagement is aligned with the need to reduce the alienation of communities from the political processes and forms part of the movement for associative democracy. Achterberg (1993, 1996) and others have expressed a role for associative democracy on the grounds that it offers increased social cooperation, coordination, and negotiated resolution to problems.

Clearly such devices as social dialogue, community consultation, and participation, and other discursive approaches have limits established by prevailing social and economic circumstances. Some scholars, such as Byrne and Yun (1999) consider that liberal democratic states are incapable of fully adopting environmental values, and reject the premises of ecological modernisation and fundamental change through administrative and economic rationalism. Of critical interest is whether more inclusive democratic approaches, and the broader notion of associative democracy, can test or extend the prevailing arrangements of social power.

LISTENING FOR THE ENVIRONMENT

Given the environmental implications of the climate change, the circumscribed exchanges that pass for the national public discourse on the subject in the U.S.A. and Australia are strangely lacking in explicit references to the environmental consequences of climate change, the future, and the implications for less developed nations and disadvantaged peoples. Instead, debate in national legislatures and elsewhere has focused largely on economic and strategic implications, while the print and televised media have focused on creating a gladiatorial spectacle of conflict over the legitimacy of climate change science. Environmental issues are an important theme in climate change research in the U.S.A. (e.g. the Global Change Research Program) and Australia, but again, this activity has rarely involved the public.

Usually, American and Australian climate change policy has been presented to the community and corporations as an issue that only vaguely threatens immediate local welfare and whose resolution will ultimately be relatively painless. For want of a better phrase, these national discourses have 'dumbed down' the issues' ethical dimensions into simple renditions of national strategic interest, corporate interest, and individual self-interest. International discourse, by contrast, has featured many expressions of differing ethical positions, and nation states, corporations, environmental groups, and others have all advanced moral arguments to support their causes and environmental interests.

Democracy, as argued above, may provide means by which policy may be formulated and implemented so as to extend the efficacy of problem-solving and theoretically, to challenge the strictures of existing social and economic limits on such activity. But democracy can only best serve to inform the process of governance – it does not necessarily inform social choice for the pursuit of environmental goals (Dryzek 1996, Saward 1996), or necessarily raise environmental issues in public discourse.

Making the case for democratising the climate change policy discourse as outlined above, made greater democracy in a democratic society and improving the outcomes of policy formulation processes broadly consistent (although challenging), with the functioning and governance of the liberal-democratic state. Expecting liberal-democratic states to operate as ecologically sustainable entities may be impossible, as Byrne and Yun (1999) argue. Yet in the absence of revolutionary change to such nation-states, the infusion of broader social and environmental values into climate change policy discourse offers a means for reform.

A rationale for broadening the climate change discourse can be rendered into democratic expressions. Firstly, since these environmental issues are being raised at the international levels and debated by representatives of nation states, NGOs, and corporations, there are few reasons why democratic societies shouldn't be partaking in national debate so that their views can be accurately expressed by their national representatives. Secondly, since the goal of the FCCC embraces environmental protection (see Articles 1, 2, and 3: UN 1999), there are equally few reasons why the national policies should not take into account the outcomes of a national discourse concerning its response to the challenges of protecting the global environment.

However, environmental ethics also suggests ways in which the environment can be pursued as having intrinsic value and to form a case for considering climate change policy as an expression of ecological justice. Consistent with arguments of Low and Glesson (1998), Stone (1987), and others, the social and environmental concerns outlined above can be collectively understood under the rubric of 'ecological justice'. Crudely expressed, ecological justice is taken here to mean a notion of justice that embraces extant and future human generations and ecological values, including living and non-living elements of current and future ecosystems (after Low and Gleeson 1998) in relation to climate change. Through the entry of ecological justice into climate change policy discourse at the national level, new issues would emerge to challenge existing presumptions and social values held by developing nations regarding their greenhouse gas emitting activities.

Annex I communities would have to consider that developing nations and disadvantaged peoples are threatened by climate change impacts through natural disasters, water supply, agricultural production, environmental services, effects on human health and other changes (e.g. IPCC 1996a, b). Developing world 'survival emissions' would become contrasted Annex I nations' 'luxury emissions' as Agarwal and Narain (1995) and others have expounded. Developed nations might have to consider more closely that linkage between the range and severity of climate change impacts to rate of global warming occurs and the options for greenhouse gas emissions reduction.

Policy-makers have sought to build public support on the basis of self-interested responses to individual decision-makers by stressing the immediate and near-term benefits of reducing fossil fuel energy use, increasing energy efficiency and so on. There appears to be a reluctance to state that present actions to meet the FCCC are premised on reducing the extent of harm that present generations will impose on our descendants. To bring such facts forward could entail the public questioning, for instance, economic assumptions of continual growth and necessity for increasing resource consumption.

Anthropogenic climate change can be considered the appropriation of the opportunities for other species to thrive and flourish as a consequence of the industrial world's operations (for the benefit of a minority of the world's citizens). Comparatively few citizens in the developed world are likely to be aware that the operation of current energy systems will directly be the cause of accelerated rates of biodiversity loss. National policies on climate change have not been explicitly formed with a view to minimizing the rate and extent of climate change in order to fulfill any human obligation to other species and the systems that sustain life on earth.

CONCLUSIONS

Satisfying the Kyoto Protocol goals, a mere 5% reduction in overall emissions of Annex I nations below their 1990 levels, may be more expeditiously met by enhanced civic engagement in the policy process. Achieving longer-term emission targets to stabilize atmospheric greenhouse gas concentrations, a task arguably 12 times harder (IPCC 1992), will surely be impossible by democratic means, however, without the active involvement of civic society.

Administrative logic tells us that we have the managerial and scientific knowledge to reach the Kyoto targets, just as the rationale of ecological modernization tells us that national management of greenhouse gas emissions will resolve the climate change problem as defined by the FCCC. But to date, overall national policies have not delivered adequate emissions reductions, despite the state of policy development and its scientific knowledge base. Conventional approaches to this problem have sought to make communication between government and community the scapegoat for failings more deeply rooted.

Engaging the community in climate change policy formulation processes may result in more effective policy implementation. Such democratization may also be promoted as a good in its own right. State experiences in community consultation offer some approaches to establishing a policy dialogue with the public. Our limited experience tells us that there is no single model for such a discourse - it will vary between places, interest groups, and issues. Policy dialogues may, for example, involve democratic representation, associative democracy, or self-determination.

There are grounds for broadening the scope of the national policy discourse so as to include those key ethical issues that have been expressed in international policy debates. When policy-makers are prepared to enjoin civil society in a policy formulation process that features democratic processes and a public discourse on ecological justice, then it will draw closer to addressing the existing limits imposed by prevailing cultural and economic norms of the liberal- democratic nation state. Until that time, progress will be bound by the contradiction of seeking to create ecologically-minded communities through governance that fails to articulate the relationships between social behavior and global ecology. Finally, even if this radical proposal to engage civic society and to openly consider ecological justice were to fail, how much worse than the current approach could it be? ❑

Note.

While the U.S.A. is the world's largest national emitter of greenhouse gases, Australia, taking its land-clearing activity into account, has arguably the highest per capita emissions (The Australia Institute 1999).

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From Global Framing to Local Action: Translation of Climate Change Impacts in Africa

O.A. Ogunseitan

In Africa, reconciliation of national development plans with global priority to mitigate climate change remains an intractable policy controversy. Its resolution requires integrating local knowledge and values into climate impact assessments. However, the communication pathways involved in progressing from frame construction to political action on environmental health issues are not well understood. This paper addresses the limitations of boundary institutions where pertinent communication nodes are embedded. Cross-scale problems in translating rhetoric and action frames can be solved by treating vulnerability assessments as dynamic processes and avenues for critical frame reflection toward equal engagement of indigenous and imported capacity for adaptation.

INTRODUCTION

The ideal outcome of global environmental impact assessments is the adoption of protective policies by vulnerable nations. For reasons that were negotiated at international summits, assessments of vulnerability to climate change in developing countries are funded through programs based in industrialized countries or through international funding regimes (e.g., the United States Country Studies Program (USCSP) and the Global Environment Facility (GEF), respectively). The priorities of these funding institutions do not necessarily coincide with development plans of recipient countries. Therefore, debates on the divergence of national and global priorities have permeated the Conference of Parties to the United Nations Framework Convention on Climate Change (UNFCCC) [Apuuli *et al.* 1999].

The principal objective of funding programs that support UNFCCC is the stabilization of greenhouse gas (GHG) concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system [Article 2 of the UNFCCC, United Nations 1992]. Therefore, the funding schemes prioritize national GHG inventories and mitigation plans over assessments of vulnerability and adaptation. Furthermore, funding for mitigation activities in developing countries has been justified by the causal history of GHG emissions, which places the burden of remediation on industrialized countries, but the agreement does not cover the financial burden imposed by the impacts of climate change in each country [Shue 1999].

Despite the availability of funds from industrialized countries, certain developing countries, notably India, have refused to participate in country study programs because of disputes surrounding issue framing, and equitable allocation of intellectual resources to national priorities [Agarwal 1990; Agarwal & Narain 1991; Kandlikar & Sagar 1997]. For developing countries that lack the means to support climate change research, the acceptance of international funds for conducting vulnerability assessments may entail the endorsement of frameworks that do not accommodate national needs. The situation is particularly salient for African countries because of the enormity of cross-sectoral infrastructure problems and the variegation of continental environmental and political systems. Therefore, an evaluation of African participation in externally funded climate change assessments is needed to identify potential shortcomings in the regimented structure of funding for climate change research. The need to integrate local knowledge and value systems into the framing of vulnerability assessments requires critical examination of communication processes that may constrain the transformation of global frameworks into adaptive action that is sensitive to the needs of developing countries.

In most of Africa, the communication pathways involved in reflective frame construction and political action for managing environmental quality and health are not well understood [Cooper *et al.* 1998; Dixon et al. 1996; Fairhead & Leach 1996; Herberlein 1977; Jaeger *et al.* 2000]. This paper focuses on one of the interfaces within which reflection on frame constructs and policy advisement occurs in the assessment of Africa's vulnerability to global climate change, namely boundary institutions that stride international and national agendas in the public health sector. Limitations to the influence of these boundary institutions are traced to cross-scale problems in the translation of rhetoric frames and the operational rigidity of institution action frames. These framing issues influence the local perception of vulnerability, and are likely to exacerbate traditional problems associated with uneven development of technical capacity, and gaps in the interest and political connection of local epistemic communities [Benioff *et al.* 1996; Carr & Mpande 1996; Long & Iles 1997; Miller 1998]. The problem can be approached by treating vulnerability assessments as long-term dynamic processes that adjust constantly to updated information on local baseline conditions. Such an approach will encourage the maturation of communication pathways necessary for critical frame reflection, and for the full engagement of both indigenous and imported capacity for adapting to climate change impacts in Africa.

The study focused on the translation of global frames of vulnerability to health impacts of climate change in the USCSP. The adoption of "*Weather, Climate and Health*" as the theme of the 1999 World Meteorological Day signified the convergence of global frames on the health dimensions of climate change, after a decade of framing and assessment activities by the World Health Organization (WHO) [World Meteorological Organization 1999]. Forty-six extension offices of WHO in Africa serve as boundary institutions where reflection on the global framework can occur to benefit local vulnerability assessments. The convergence of global frameworks also involves other boundary institutions whose concerns underpin public health security in Africa. The Consultative Group on International Agricultural Research (CGIAR), which focuses on preventing malnutrition, exemplifies such boundary institutions. CGIAR is co-sponsored by The World Bank, The Food and Agricultural Organization, the United Nations Development Program, and the United Nations Environment Program. The International Institute for Tropical Agriculture (IITA) is a CGIAR-sponsored organization with headquarters in Africa. The responsibility of translating the global framing of climate change impacts in Africa is embedded in IITA's agenda for applied research, policy advice, and extension education [IITA 2000].

CROSS-SCALE ISSUES IN FRAMING VULNERABILITY TO CLIMATE CHANGE

The concept of framing adopted in this study was developed by Schon and Rein [1994] in a constructivist approach towards understanding how scientists and policy makers make the normative leap from findings of fact to policy recommendations, i.e. from the "is" to the "ought". In this view, frames are implicit assumptional structures that spring from generative metaphors. Policy controversies are considered as frame conflicts that may yield to careful frame construction and reflective communication in policy discourse. In extending this concept to transnational policy controversies on environmental issues, the present study unveils the intricately connected dimension of scale that has been absent in the previous treatments of frame reflection. The problem of scale differentials in international environmental assessments has been confronted by several investigators, but theoretical breakthroughs on how to resolve the policy disputes that they generate have not been forthcoming [Clark 1987; Kates *et al.* 1985; Turner *et al.* 1991]. Practical insights into the resolution of scale problems are particularly relevant to the understanding of frame communication between multinational environmental regimes and policy development in less developed countries [Smith *et al.* 1996; Usher 2000; Watson *et al.* 1997].

The model presented in Table 1 maps the nodes and objectives of frame communication between transnational and national stakeholders in the assessment of Africa's vulnerability to the impacts of climate change. The major actors in the framing of climate change are *scientists* who require international collaboration, *policy makers* who expect advise on risk management, and the *public media* where scientific and policy controversies are highlighted in the struggle for legitimacy [Cronon 1992; Kempton 1991; Pittock & Jones 2000; Stern *et al.* 1992]. Strategies for building consensus in global environmental assessments rely on managing the communication pathways among the flexible categories of actors [Jasanoff 1996]. The structure of transnational communication pathways affects framing issues in vulnerability assessments where they play a key role in translating knowledge of climate change to the implementation of "no regrets" adaptation strategies [Apuuli *et al.* 2000].

Translation of Rhetorical Frames

Rhetorical frames are persuasive stories and lines of argument that are used in policy debate [Schon & Rein 1994]. They are commonly found in the discourse on environmental change, where they serve to gain allegiance in the coalition of advocacy groups [Homer-Dixon 1990; Snow & Benford 1992]. For example, the rhetorical frame of equity is prominent in the North-South debate on global climate change, but it has not evolved into dominant action frames that inform policy practice and the content of legal frameworks and procedures [Agarwal & Narain 1991; MacLean 1990; Magazda 2000; Shue 1999]. Rhetorical frames have also been used in speculations and projections about the impacts of human-induced climate change. The stories are based on observations of pervasive effects of natural climate variability on social and ecological systems [Cronon 1992]. Although scientists who participate in global environmental assessments strive to reduce uncertainties in the attribution of causes to the global warming phenomenon, it is far more difficult to ascertain, beyond rhetoric reframing, that unusual events are in fact due to the actual impacts of human-induced climate change [IPCC 1997].

Probably no other frame of climate change impacts commands more attention than putative human health consequences. The emergence of new infectious agents, and the geographic spread of tropical diseases have equally engaged the attention of journalists, novelists, movie producers, and public health officials [McMichael & Sari Kovats 2000; Wilson *et al.* 1994]. With the possible exception of Hanta virus and Lyme disease epidemics in the United States, the usual suspect for the origin of new disease pathogens is the African continent. Indeed, the tumultuous conflict of frames that accompanied the debate on the African origin of the HIV virus has not entirely succumbed to intense scientific research. South African president Thabo Mbeki's recent questioning of the link between HIV and AIDS has rekindled deep-seated controversies among health scientists and policy-makers worldwide [Cohen 2000]. The struggle by many African countries to prioritize multiple issues of environmental quality and health has increased reliance on foreign financial and technical assistance, while discounting the notion that foreign aid is usually accompanied by the requirement to reframe national priorities through the assimilation of foreign values [Watts 1987; Rich 1994].

Rhetorical frames used in generating attention to health impacts of climate change follow the classical model of "fear appeals" [Jayne, 2000]. "Fear appeal" strategies are two-pronged communication tools. The first prong focuses on the magnitude of the threat and on individual or group susceptibility to the defined threat. The second prong identifies recommended responses and the efficacy of adaptive strategies. An example of "fear appeal" framing is the emergence of the "Roll Back Malaria" initiative within the climate change agenda [WHO 1997]. "Roll Back Malaria" (RBM) can be viewed as a generative metaphor in the construction of rhetorical frames pertaining to the health impacts of climate change. Its goal is to expand the geopolitical range of support for malaria research. The RBM initiative was launched, soon after Gro Harlem Brundtland's inauguration as director of WHO, as an extension of the provincial Malaria Control program initiated by the Organization for African Unity in 1995. Global financial support for RBM is crucial, which necessitates the rhetorical framing of malaria as a global problem. The director of RBM, David Nabarro, has effectively constructed a rhetoric frame, based on the fear appeal strategy, of malaria's threat to the Northern Hemisphere as a consequence of climate change impacts on the viability of ***Plasmodium*** [IPCC 1997]. Nabarro's communications assert that "malaria was once a problem in the US and may return" and that "malaria kills more US troops than bullets" [Nabarro 1999]. Also noteworthy is the statistic that 62,000 indigenous cases of malaria were recorded in central Europe in 1998 [WHO 1997; Martens & Hall 2000]. At the international summit on RBM held in Nigeria in April 2000, Brundtland reinforced the global framing of malaria in the context of climate change. The forgiveness of Africa's debts owed to countries in the Northern Hemisphere was requested to enable African nations in stemming the spread of malaria [Nwaorgu & Johnston 2000; Sachs 2000].

But WHO's assessment of the global burden of diseases that are susceptible to climate change suggests a decline in Africa's malaria burden in the period from 1990 to 2020 (Table 2). The assessment also indicates a more rapid decline in malaria burden outside Africa, because the proportion of global burden of malaria that is associated

TABLE 1. Summary of Communication Nodes and Objectives in Transnational Framing of Vulnerability Assessments

NATIONAL (LOCAL) SCALE (AFRICA) ↓

TRANS-NATIONAL (GLOBAL) SCALE →

	SCIENTISTS	**POLICY MAKERS**	**PUBLIC/MEDIA NGOs**
SCIENTISTS	Predictive Models Local Baseline Data *Primary Frame Communication and Reflection*	Credibility, Validation Risk Communication	Access to Indigenous Knowledge
BOUNDARY INSTITUTIONS	*Secondary Frame Communication and Reflection* *Capacity Development Constrained within Action Frames*	*Implementation of Action Frames* *Incidental Reframing and Frame Negotiation*	Emergency Intervention *Extension Education And Frame Recognition*
PUBLIC MEDIA NGOs	*Tertiary Frame Communication and Reflection*	*Translation of Rhetoric Frames* Support for Advocacy Coalitions	Shared Values Socialization *Metacultural Frame Network*

Modified from Jasanoff & Miller (personal communication, 1999). The Global Environmental Assessment Project, Harvard University.

with Africa is expected to increase, even though the actual burden of malaria in Africa will decrease. This is the case for all climate-sensitive diseases in Africa, except for respiratory ailments, and eye diseases attributable to ultraviolet light exposure (Table 2). Therefore, it is not possible to reconcile the rhetorical framing of RBM with policy recommendations suggested by independent assessments conducted by the IPCC and the WHO [IPCC 1997, and Table 2]. The framing of beneficial impacts of climate change has emerged in the United States [Mendelsohn and Neuman 1999]. Such frames remain controversial, but their publication demonstrates a capacity for frame translation to suit particular local agendas. Entertainment of diverse frames is essential in vulnerability assessments if optimum adaptive strategies are desired. Within the confines of present rhetorical frames, suggestions that certain diseases might benefit from climate change in Africa will likely meet with resistance. Similarly, the idea that AIDS in Africa could be exacerbated by climate change-induced increase in ultraviolet light exposure (which is known to suppress the immune system) is not supported because it disagrees with the dominant global framing of the AIDS epidemic [WHO 2000]. The pervasive nature of projected climate change impacts in Africa suggests the need for a sustainable strategy for coordinating vulnerability assessments through a process that encourages reflection on multiple frames and skepticism in the adoption of global frameworks.

Flexibility of Action Frames

Three levels of action frames are generally recognized; policy, institutional, and metacultural. Policy frames are used to construct problems in specific policy situations, whereas institutional frames structure broad policy problems in a manner that is characterized by institutions' political mandate and system of beliefs. Institution frames are local expressions of culturally shared systems of belief or metacultural frames, which are organized around generative metaphors such as the oppositional pairing of cause and effect, global and local, disease and cure, developed and developing, and even science and policy [Schon and Rein, 1994].

It is widely believed that Africa is highly vulnerable to climate change [Dixon *et al.* 1996; IPCC 1997; Magazda 2000; WHO 1990]. This view can be traced to the frequency of socio-ecological devastation that results from major climate variations on the continent. The incidence of famines, homelessness, and disease epidemics that require international assistance seems a testimony to the weakness of policy and institution action frames employed in the strategy to cope with climate- and weather-related emergencies. However, the valuation of climate change impacts has a subjective dimension that can only be captured through indigenous experience and an understanding of values associated with life-saving intervention programs.

A recent study of individual time preferences for life-saving programs concluded that the discount rates applied to future life-saving programs by Africans are very different from the rates applied in developed countries, and that the difference ought to be reflected in national development programs and transnational initiatives for capacity building. Clearly, the relationship between time preferences for saving lives and the discount rates applied to intervention programs is not as simple as previously believed [Poulos & Whittington 2000]. In Africa, as in other regions, the perception of climate change and its impacts remains futuristic [Kempton 1991]. Therefore, national differences in time preferences for life-saving programs are expected to affect the adoption of climate change action frames. This is why cross-national assessments of vulnerability and adaptation have posed substantially more challenges than the assessment of GHG inventories and mitigation options [Pitock & Jones 2000].

The current framework for climate change impact assessments is based on probability projections from general circulation model scenarios and base-line data on coastal resources, agriculture, forests, desertification, fisheries, biodiversity, and human health. This list of sectors is not exhaustive, and the inclusion of "high-visibility" sectors in impact assessments is a function of institution action frames [Long & Iles 1997]. In applying for funds to conduct vulnerability assessments, developing countries are confined to institution action frames of the funding agreement. In certain cases, methodological constrains are also imposed on the conduct of vulnerability assessments [USCSP 1999; GEF 1999]. Rigid institution action frames may facilitate consensus building and the production of synthesis reports, but they may also adversely affect the ability of African countries to develop frame

TABLE 2. Summary of Africa's Share of the Global Burden of Diseases Impacted by Climate

Disease Category	1990 DALYs[a]		2000 DALYs		2010 DALYs		2020 DALYs	
	% of Total African Burden	**Africa's Share of Global Burden Within Category (%)**	% of Total African Burden	**Africa's Share of Global Burden Within Category (%)**	% of Total African Burden	**Africa's Share of Global Burden Within Category (%)**	% of Total African Burden	**Africa's Share of Global Burden Within Category (%)**
Malaria	9	**85**	8	**91**	6	**93**	4	**94**
Diarrhea	11	**32**	9	**41**	7	**46**	5	**49**
Dengue	< 0.1	**3**	< 0.1	**5**	< 0.1	**6**	< 0.1	**6**
Tropical[b]	2	**52**	1	**58**	1	**64**	0.5	**73**
Malnutrition[c]	3	**18**	3	**24**	2	**28**	2	**30**
Respiratory[d]	3	**13**	3	**13**	4	**14**	5	**15**
Eyes[e]	1	**19**	1	**19**	1	**19**	1	**20**
HIV[f]	3	**75**	6	**51**	6	**42**	4	**33**

[a] Disability Adjusted Life Years Lost (Murray and Lopez, 1996)

[b] Insect vector-borne tropical-cluster diseases includes Trypanosomiasis, Schistosomiasis, Leishmaniasis, Lymphatic Filariasis, and Onchocerciasis.

[c] Nutritional deficiencies include: Protein energy malnutrition, Iodine deficiency, Vitamin A deficiency, and Iron deficiency anemia.

[d] Chronic Obstructive Pulmonary Disease (COPD) and Asthma

[e] Cataracts and Glaucoma

[f] HIV is included primarily for comparison, but the impact of climate change-induced population destabilization on the HIV epidemic should be taken seriously. Also, the impact of ultraviolet light exposure on the immune system is a concern for the prognosis of AIDS.

Data extracted from Murray and Lopez 1996 (baseline scenarios)

communication pathways required for dynamic vulnerability assessments that respond to updates in baseline conditions and methods of analysis.

The assessments conducted by the Intergovernmental Panel on Climate Change (IPCC) have become the operational center for the development and dissemination of action frames regarding global climate change impacts. In general, IPCC assessments have endorsed the framing of Africa's extreme vulnerability to climate change, but with particular focus on human health, food security, and water [IPCC 1997]. These three sectors manifest collectively as public health concerns, and they were emphasized among other vulnerable sectors, including biodiversity, dersertification, and coastal settlements and infrastructures. The IPCC action frames also operate within each vulnerable sector. For example, within the human health category, climate-induced changes in the burden of malaria, schistosomiasis and dengue/dengue-hemorrhagic fever are expected to dominate the design of pre-emptive adaptation strategies [IPCC 1997; WMO 1999]. The benefit of a focused action frame is to encourage policy agreements, but in the scarcity of baseline data, there is a danger of uncritical adjustment of national priorities for the benefit of gaining international financial support [Cooper *et al.* 1998].

In countries such as Nigeria where 90% of the economy depends on petroleum mining in the coastal Niger delta area, vulnerability to sea level rise, and the consequences of reduced market for carbon-based fuels have overshadowed other climate change concerns [Umolu 1994]. The Africa region also includes countries at the extremes of energy utilization and economic efficiency. For example, Gabon operates a highly energy efficient economy (the GDP output/kg oil-equivalent in 1996 was 3.3, compared to 3.4 for the United States), but it exists in the same "IPCC region" as some of the most inefficient economies, such as Nigeria with a GDP/kg oil equivalent of 0.4 in 1996 [UNDP 1999]. Therefore, if national vulnerability and adaptation assessments are independent of institution action frames, the variety of economic and environmental concerns in Africa should be reflected in the record of participation in internationally-funded country study programs, and in the expression of apathy to the UNFCCC [Lopez 1999]. The following analysis of USCSP illustrates the ways in which institution action frames can influence assessments of vulnerability in Africa.

Fifteen African countries currently participate in the USCSP, a voluntary program inaugurated in 1993 with the primary objective of building institutional and technical capacity for global climate change assessments in developing and transition countries [USCSP 1999]. Eleven of the fifteen countries are in Southeastern Africa and only three are in West Africa. The USCSP staff attributed the skewed geographical representation of African countries to national differences in the interest of scientists and/or their influence on policy makers who must endorse the participation. However, the USCSP action frame clearly influenced the decision of countries on whether or not, and to what extent, to participate from the moment the program was inaugurated [Guill, Fitzgerald & Huang 2000].

Sectoral vulnerability and adaptation assessments conducted by African participants in the USCSP is presented in Table 3. Based on the coverage of sectors by the countries, it is possible to deduce that climate impacts on agriculture, water resources and forests dominate the concerns of African countries, in contrast to the IPCC assessment described above. However, another plausible explanation is that the selection of sectors represented in vulnerability and adaptation assessments is a direct reflection of the institution action frame tacitly imposed by the USCSP program. This latter view is supported by the fact that the first international workshop to include human health vulnerability and adaptation to global climate change occurred in 1995 in Harare, Zimbabwe [Dixon *et al.* 1996]. But as early as 1990, WHO that retains representatives in 46 African countries had issued a report on the potential health impacts of climate change [Figure 1; WHO 1990]. By 1999, only Zambia had produced an itemized assessment of human health vulnerability to climate change. The Zambia assessment focused on malaria, bilharzia/schistosomiasis, cholera, bubonic plague, and malnutrition [USCSP 1999], but projections of climate change impact on the incidence of these diseases were hampered by the paucity of baseline data on health statistics. Coverage of the health sector in African assessments of vulnerability to global climate is broader than its coverage in other geographical regions involved in the USCSP. Only two other countries (Sri Lanka and Thailand) out of 40 countries in Asia, Latin America, and Central Europe have conducted assessments of vulnerability to the health impacts of climate change under the UNFCCC framework [USCSP 1999].

The USCSP faces disestablishment after seven years of waning federal support. The program has assisted many developing countries in initiating indigenous environmental assessments, but the test of capacity development is the sustainability of local vulnerability assessments that engage responsive, long-term frame reflection. Relief from the constraints imposed by institution action frames can occur through building flexibility into the translation of global frames endorsed by the parent organizations of boundary institutions. This will require a commitment to frame experimentation and a willingness by transnational funding programs to yield to the outcome of frame reflection in local assessments of the impacts of climate change. However, the potential benefits will favor development of sustainable capacity in a way that supports the requirement for open-ended vulnerability assessments.

CONCLUSION

The decision to conduct impact assessments of global environmental change depends on the perception of vulnerability by local scientific and political institutions. The perception and assessment of vulnerability are both influenced by factors related to issue framing. In countries with limited capacity to engage in large-scale assessment of every conceivable impact, the persuasiveness of rhetorical frames in vulnerability assessments is of paramount significance. Rhetorical frames are useful for drawing local attention to global issues, and vise-versa. But effective frame translation from global concerns to local relevance can be constrained by institution action frames when financial arrangements require the endorsement of problem definition and methodological approaches. In Africa, boundary institutions that represent global visions while maintaining national visibility occupy a special node in the communication pathways required for translating global frameworks into local action. In the health sector, boundary institutions such as WHO and CGIAR have access to local scientists, policy makers, and the public through their roles in capacity development, policy advice, and extension education. To these functions

TABLE 3. Summary of Sectors Covered in Vulnerability and Adaptation Assessments by African Countries participating in the United States Country Studies Program

Country	Coastal Resource	Agriculture	Grassland And Livestock	Water Resource	Forests	Fishery	Wildlife	Human Health
Botswana			*	*#	*	*		
Cote d'Ivoire				*	*			
Egypt	*#	*#		*				*
Ethiopia		*	*	*	*			
The Gambia	*#	*	*	*	*	*		
Kenya		*		*	*	*		
Malawi				*	*		*	
Mauritius	*	*		*		*		
Mozambique	*	*	*	*	*			*
Nigeria[a]	*				*			
South Africa		*	*	*	*	*	*	*
Tanzania	*	*	*	*	*			
Uganda		*	*	*	*			
Zambia		*	*	*	*		*	*
Zimbabwe		*			*			

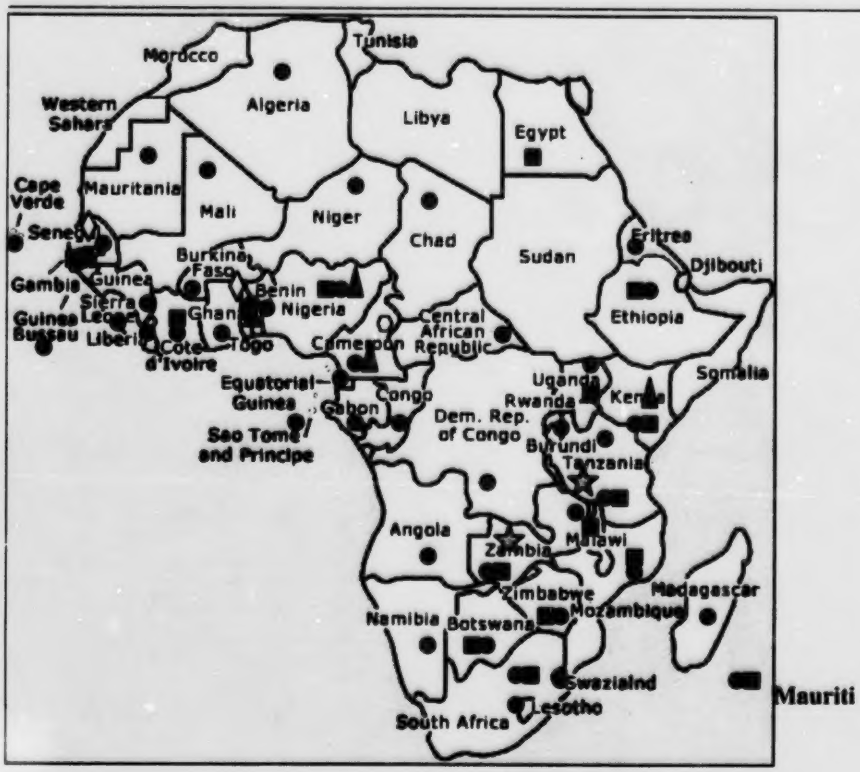
* Vulnerability Assessment
# Adaptation Assessment
[a] Completed under the Global Environment Facility Program.

U.S. Country Studies Program 1999.

must be added the responsibility for developing capacity for reflective frame construction to facilitate integration of local knowledge and values into climate change vulnerability assessments.

This research suggests that if the boundary institutions responsible for public health security have not been very effective in resolving the policy controversy surrounding Africa's participation in climate change assessments, it is due in part to limitations imposed by cross-scale issues in framing. Credible projections of health impacts of global climate change are particularly difficult because much of the information required for the exercise are rooted in local circumstances and baseline data that are fraught with uncertainties [McMichael & Sari Kovats 2000]. Moreover, theoretical underpinnings of the relationship between environmental quality and human

FIGURE 1. Distribution of Boundary Institutions and Epistemic Communities Engaged in Framing Vulnerability Assessments in Africa


Morocco
Tunisia
Western Sahara
Algeria
Libya
Egypt
Cape Verde
Mauritania
Mali
Niger
Chad
Sudan
Senegal
Eritrea
Djibouti
Burkina Faso
Gambia
Guinea
Benin
Sierra Leone
Nigeria
Ethiopia
Guinea Bussau
Liberia
Ghana
Central African Republic
Cote d'Ivoire
Togo
Cameroon
Somalia
Equatorial Guinea
Uganda
Congo
Rwanda
Kenya
Gabon
Dem. Rep. of Congo
Sao Tome and Principe
Burundi
Tanzania
Angola
Zambia
Malawi
Zimbabwe
Madagascar
Mozambique
Namibia
Botswana
Swaziland
Lesotho
South Africa
Mauriti

■ Countries participating in the US Country

▲ CGIAR Centers; International Institute for Tropical Agriculture

● World Health Organization Representatives (Africa Region)

☆ German GTZ Country Studies Program

◊ Netherlands Country Studies

○ GEF/UNEP Country Studies Program

health have traditionally marginalized the dynamic nature of regional vulnerability, group susceptibility, and social adaptation [Lucas 1998].

Efforts to reduce Africa's dependence on global emergency health response systems will require the development of autonomous capacity to anticipate and adapt to natural disasters. Without appropriate frame reflection at the local level, globally framed assessments tend to marginalize indigenous adaptive experience and value systems [Carr & Mpande 1996]. Theoretical advances in social studies of science suggest that tacit assumptions about motives, public values, social order, and communication pathways influence cross-scale translation of norms and frames in global environmental regimes [Clark 1987; Jasanoff 1996; Turner *et al.* 1991]. Uncritical frame reflection can lead to value conflicts, inadequate policy development, and loss of opportunities for articulating indigenous solutions to global problems with serious local repercussions. Improving the role of boundary institutions in cross-scale vulnerability assessments requires continuous evaluation of how the framing of climate change impacts is translated across geographical, political and cultural boundaries under constraints imposed by the structure of funding for global environmental assessments. ☐

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Who are Our Neighbours? Personal Automobile Choice, Climate Change and Ethics

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On the assumption that the private automobile will be the transportation choice for some time yet, this paper argues a personal ethic of responsibility can be easily exercised by choosing to drive smaller, slower, and shorter. Such an ethic is grounded in the biblical "golden rule", and is common to many religions. The universality of that rule is developed, consistent with the need to view our neighbourhood as indeed the globe. As most North Americans admit to religious belief or sentiment, there is in this argument an opportunity for religious institutions to express their teachings regarding stewardship in a practical, personal way.

INTRODUCTION

Organized religions have not been unmindful of the environmental crisis and the need for a faith-based response, although they may have been tardy off the mark. Lynn White's (1967) ascription of the historical root of the environmental crisis to Genesis (1:28)—the commandment to have dominion over the earth—served as a wake-up call to many religious organizations to reconsider and re-invigorate their teachings on stewardship. Western religions now commonly view environmental problems as fundamentally moral or belief issues. Thus, for example: the World Council of Churches (1994, 28), "The crisis arising from accelerated climate change is a challenge to the life and witness of Christians"; the U.S. National Conference of Catholic Bishops (1998), "At its core, the environmental crisis is a moral challenge"; the Evangelical Environmental Network (2000), "many environmental problems are fundamentally spiritual problems"; and, the Coalition on the Environment and Jewish Life (2000), "[environmental] issues ... are at their heart about our most basic obligations, the biblical imperatives to choose life and pursue justice". From this standpoint, organized religions have proposed a variety of actions consistent with their emphasis on stewardship. They have made presentations to government, lobbying for example in favour of redefinition of mandatory average fuel efficiencies (e.g., Coalition on the Environment and Jewish Life 2000). They have developed educational and exhortative materials for their members, emphasizing the need for individual daily life consonant with their faith principles.

Apart from these efforts of the institutions of organized religion, other people of faith contend that the "real environmental problem may well be the belief that there exists a terrifying problem rather than any problem in itself" (Fradkin *et al.* 2000). The Acton Institute for the Study of Religion and Liberty, for example, "seek[s] to build prosperity on a foundation of religious liberty, economic freedom, and personal moral responsibility ... [by] educat[ing] future religious leaders in the principles and processes of free enterprise, highlighting the moral dimensions of liberty and the market system" (Acton Institute 2000a). On the face of it, the Acton Institute's program does not seem different from the statement of the National Conference of Catholic Bishops (1998) that "[w]e must seek a society where economic life and environmental commitment work together to protect and to enhance life on this planet". More than 1000 people had by mid-2000 added their names as individuals, not as representatives of religious institutions, to the Cornwall Declaration on Environmental Stewardship, sponsored by the Acton Institute. The Declaration derives from biblical sources and religious principles strong support for a libertarian philosophy of distributive justice. "[T]he two Great Commandments (to love God and neighbor) [are] the supreme rule of all conduct", states the Declaration (Acton Institute 2000b); "Human persons are moral agents for whom freedom is an essential condition of responsible action".

The Cornwall Declaration does not spell out the nature of personal responsibility, but the statement of concern clearly indicates a preference for issues in the (constricted) here and now, and a mistrust of any problem on (more indistinct) space and time scales that would call for application of the precautionary principle. The Declaration is not clear on how moral agents will be guided in making choices that lead to the desired end of sustainable economic development (although it does not use that term). There is a gap between thought and action, between belief and actualization. This gap is not restricted to one side or the other; it has been noted often. "This disjunction of theory and practice is present within all philosophies and religions" (Tucker and Grim 1998, xx). Welchman (1999, 413) noted that resolution of large issues such as global warming needs "long-term commitments by individuals who cannot expect any direct benefit to themselves or their communities as a result." She asks if enlightened anthropocentricism will be sufficient to the task, noting that people will not be motivated to preserve values that are "fundamentally inconsistent with our predominant dispositions to action" (p. 413). Welchman (p. 423) concludes that we need to understand how love of self and neighbours can supply the reqisite motivation.

The nature of the climate change problem is such that we must recognize the global implications of personal activity. As automobiles are a significant source of greenhouse gas emissions, and their use is entirely at the discretion of their owners, they are a useful example for the development of a personal ethics of responsibility (I borrow the term from Wurzberger 1994). I develop the common religious principle known as the golden rule to suggest its universal applicability, providing a basis for such an ethics. Religious institutions are responding to the environmental crisis with faith-based teachings of stewardship and personal responsibility. The interpretation here of the golden rule is consistent with both religious teaching and arguments from secular ethics.

AUTOMOBILES AND CLIMATE CHANGE

Global climatic change due to anthropogenic emissions of greenhouse gases seems our likely future, although the precise magnitude, timing, and spatial variability are uncertain (Houghton et al. 1995). Whether over-consumption in the developed world or population growth in the developing world is the more culpable, and whether responses should emphasize avoidance by limiting emissions or adaptation to inevitable change, are questions of intense debate. There is no doubt, however, that the problem is global, affecting both emitters and non-emitters. At the Kyoto 1998 Conference of the Parties to the Framework Convention on Climatic Change, agreement was reached to effect emissions reductions to 1990-levels by the period 2008–2012.

North America leads the world in both total and per capita emissions of greenhouse gases (Engelman 1998). In North American society, the transportation sector is one of the most important contributors to the emissions total. In Canada in the early 1990s, transportation was the largest sectoral contribution, at 26% of the total (Environment Canada 1995); in the United States at the end of the 1990s, cars and light trucks accounted for 20% of total carbon dioxide (Mesnikoff, 2000, personal communication).

The private automobile will likely remain a defining characteristic of North American life for many years to come, and the fossil-fuel powered internal combustion engine will remain the most prevalent power plant for many years yet. Reduced emissions from automobiles may be achieved in many ways, from the use of alternative fuels and improved engine and aerodynamic efficiencies, to modal shift to public transportation, to urban redesign to de-emphasize home-to-work transportation. Many of these changes must occur in the corporate or governance spheres, but the choices of individual drivers can also play an important role in achievement of the agreed emission reductions. For the individual, three very simple behavioural choices are available that would make a significant difference without noticeable effect on quality of life. These choices are to drive smaller, slower, and shorter.

FACTORS OF PERSONAL CHOICE

At the point of purchase, the individual can choose a smaller vehicle. Smaller vehicles are more fuel efficient than larger ones, because there is less inertia to overcome and there is less wind resistance in motion. Recent data show that the fuel efficiency of the best small cars is up to half-again as much as that for the best mini-van or sports utility models (American Council for an Energy-Efficient Economy 2000). As most automobile trips are made with fewer than two people per vehicle, and as most trips are in urban traffic, the choice of a smaller vehicle would result in marked reduction of emissions.

Regardless of vehicle, the individual driver has control over two other significant behaviours that can markedly affect fuel use and carbon dioxide emissions. One is to drive slower in high-speed conditions. Fuel efficiency of any vehicle is maximum at moderate highway speeds. Urban driving is associated with poor efficiency because of frequent stop-and-go conditions. The urban efficiency rating for a vehicle is typically between 70% and 80% of its highway efficiency (American Council for an Energy-Efficient Economy 2000). In unimpeded highway driving, fuel efficiency decreases from an optimum at about 80 km/h as wind resistance increases; aerodynamic drag varies as the square of velocity, so the effect is actually very dramatic (Hughes 1993, 47). The second behavioural change is to drive less. Urban design and the distribution of work and residential sectors preclude much individual choice in driving distances. If one is unwilling or unable to choose residence close to work or to shift to public transit, a significant difference may nevertheless be made easily by ride sharing. The appropriate measure of the impact is emissions per passenger-distance, not emissions per distance. Total passenger distance is increased by ride sharing, and per capita emissions are correspondingly reduced. In effect, ride sharing is equivalent to shorter distances per person.

Meaton and Morrice (1996) argued, from Mill's theory of freedom, that society would be ethically justified in imposing an outright prohibition of private automobiles, although a stepwise approach would be political and practical. Smaller, slower, and shorter do not impinge on one's right to own and operate a private automobile. The shift for most people would not be a hardship or decrease in quality of life, only perhaps in perceived status. These choices could, depending on the actual vehicles and driving patterns, reduce the owner's personal contribution to carbon dioxide emissions by several tons per year. If the election of smaller, slower, and shorter is obvious and easy, then the question is why it is not made.

The message that automotive behaviour is important in terms of greenhouse gas emissions is lost on most people. Carbon dioxide cannot be seen, it does not affect the primary activity of driving, the atmospheric effect is not here and now (and is not visible anyway), and the amount released per person per day is very small. Human behaviour, especially as consumer, is often analyzed in terms of economic value. If smaller, slower, and shorter can reduce fuel use by up to half or more, then the economic benefit should be obvious to the individual driver. The savings in annual fuel costs, however, would amount to less than C$1000 at current prices, an amount that is a very small fraction of the amortized cost of the larger vehicle, and well less than the annual insurance premium. That is to say, it is unlikely that the economic incentive will be very persuasive under current market conditions in North America. (If society were willing to price gasoline at levels such as in Europe, three to four times the current price, the incentive to drive smaller, slower, and shorter would be much stronger.) Ford Motor Company undoubtedly recognized this lack of incentive for the consumer in its recent announcement that, although it recognized its SUVs were environmentally unfriendly, it would continue to manufacture them because of the profits they represented for the company (Bradsher 2000).

OPPORTUNITY FOR RELIGION-BASED PERSONAL ETHICS

A commonly made ethical argument is that individual freedom should not be infringed so long as individual actions do no harm to others. Meaton and Morrice (1996) contend that private automobile use must be categorized as an "other-regarding" action, because of the harmful effects of emissions on both local air quality and global climate change. Thus, Meaton and Morrice, argue, there is ethical justification for societal regulation of automobile use. Economic and secular ethical arguments have so far been ineffectual in changing behaviour. What is needed, some argue, is a worldview that affects how we act, not just how we think; a prescription for action that is generative (Taylor 1998). Inculcation of a personal ethics of responsibility by religious institutions may be such an approach.

In our modern world, does it make sense that there is a role for religions? There is strong religious sentiment in North America, albeit latent or not practiced. In 1997, 96% of Americans stated they had religious belief, even though only 41% said they went to Church every week (New York Times, quoted in Religions in America 1998);

these proportions were unchanged from 1947. The numbers are more modest in Canada, yet still point to widespread religious belief. An Angus-Reid poll in 2000 showed that "[w]hile 84% believe in God, just 20% attend church weekly . . .; attendance has plummeted [since the mid-1940s] while belief in God has remained stable" (Angus Reid World Wide 2000b). Fully two-thirds stated that religious faith was very important to their daily life (Angus Reid World Wide 2000a). This religious attachment is primarily to Christianity (87% in the U.S., 82% in Canada), although there is rapid growth in numbers of adherents to eastern faiths. As religious teachings provide our basic worldview, it might be expected that a large majority of the population might be amenable to a message emanating from our religious institutions.

THE GOLDEN RULE

Perhaps the most commonly know religious maxim in Western religions (those that claim the Hebrew Bible, or Old Testament, as scripture) is the "golden rule". Its Biblical basis is in Leviticus 19:18: "you shall not avenge, nor bear any grudge against the children of your people, but you shall love your neighbour as yourself". The inter-generational ethic of justice is clear in the reference to children, that is, to future generations. But, we may ask, who are our neighbours? Who is referenced by "your people"? A narrow reading would seem to restrict the injunction to one's own socio-religious community. In the context of Leviticus, the law implied that one's neighbours were the other Israelites on the exodus but not the people they moved and lived among.

How is love of neighbour to be realized? At the turn of the Common Era, two millennia ago, the great rabbi Hillel (flourished about 30 BCE) taught, "What is hateful to you, do not do to your neighbour; that is the whole Torah; the rest is commentary; go, study" (Talmud, Tractate Shabbat 31a). That is, the injunction of love for neighbour is the most central concept. Self-examination (to define what is hateful to oneself) and avoidance of harm (to avoid doing it to others) is the proper path.

This teaching is not restricted to Hillel and Judaism. The golden rule also appears in non-Western thought. Tu (1998, 5), writing about Confucianism, noted the need for "replacement of the principle of self-interest [formulated in the western Enlightenment] ... with a new Golden Rule: 'Do not do unto others what you would not want others to do unto you' [Analects 12:2]." This "new" rule, of course, is parallel to Hillel's formulation. Tu argues that, since this rule is stated in the negative, it needs to be augmented by the positive "in order to establish myself, I have to help others to enlarge themselves [Analects 6:28]". This formulation is parallel to the statement of the Golden Rule by Jesus: "Therefore all things whatsoever ye would that men should do to you, do ye even so to them: for this is the law and the prophets" (Matthew 7:12). Like Hillel, Jesus identifies the golden rule as the kernel of religious teaching on the moral life.

Hillel's statement of the golden rule, it has been pointed out numerous times, is in the negative form: do not do. In contradistinction, the phrasing by Jesus near the end of his sermon on the mount is positive: do. Is there a fundamental difference between the negative and positive forms? Hillel would have one undertake self-evaluation. Identification of what one wants might be easy (perhaps facile), of what one would not want more difficult. Think of an action, and think through to its consequences—this calls for more introspection than simply gratifying desires. Hillel seems to demand that one avoid interfering or doing harm to others, not necessarily to do good for them. Very early, though, rabbinical interpretation was that the Levitical commandment was not merely "enjoining malfeasance but mandat[ing] beneficence" (Wurzburger 1994, 45). Jesus, in contrast, calls for one to be altruistic, to do good for others, because that is what one would like to receive for oneself. Jesus does not go so far as to suggest that one's motivation is expectation of reward. Hillel's form may be a recognition of the reality of human existence, that the best that can be achieved is refrain from harm. In modern terminology, it may be a precursor of the precautionary principle. Jesus' form may be a hope for the perfectibility of human behaviour.

The negative and positive forms of the golden rule correspond to the concepts of negative and positive natural human rights in philosophies of distributive justice (Wenz 1988). Negative human rights are the rights to non-interference, to being left alone. Others are only required to refrain from actions that interfere with another's fundamental rights, such as to life; some thinkers also include rights to liberty and property as fundamental.

People should refrain from any action the consequences of which impinge on the rights of any other person with ethical standing within the sphere of concern, whether a proximate neighbour or not. Negative rights, thus, are similar to Hillel's formulation of the golden rule. Positive human rights require people to assist one another in at least satisfying, if not maximizing, their access to social good (adequate health care, for example). Positive rights, thus, are similar to Jesus' formulation of the golden rule. Given the very human, and justifiable, predilection for self-preservation, self-interest is often much stronger than altruism. Glatzer (1966, 95 fn.1) noted the "strong practical appeal" of the negative version of the golden rule.

If only negative human rights are incumbent on people, a libertarian theory of distributive justice might be argued. If positive human rights are also incumbent, then a utilitarian theory of justice would be argued to be more adequate. Kant's categorical imperative—people should act according to principles they would want everyone to use—suggests that both negative and positive human rights are valid and incumbent upon people (Wenz 1988). Thus, it may not matter in which formulation one prefers to quote the golden rule, as long as one recognizes its broader and inclusive implications.

WHO ARE OUR NEIGHBOURS?

This consideration of the golden rule has suggested that it implies intergenerational considerations. But who are our neighbours? Are they only those of our own socio-religious group who are proximate to us? In Hillel's dictum, the noun often translated as "neighbour" (*chaver*) is better, and sometimes, translated as "friend", "associate", or "colleague". It carries the sense of communion with others in some joint endeavour or enterprise. In the Talmud, *chaver* had the more specific connotation of "a person who became a member of a group dedicated to the precise observance of *mitzvot* [commandments]" (Steinsaltz 1989, 188). A *chaver* was a member of an exclusive elite, keeping his distance from and mistrustful of the common people. In later practice, all Torah scholars were given the designation of *chaver*, as were some commoners and even some of the Samaritan sect.

That Hillel meant his teaching to be universal, though, can be argued for several reasons. First, he may have been quoting a popular saying that predated him by some centuries. Second, Hillel and his school are widely recognized in Talmud as being more lenient and more thoughtful of the masses than their chief rivals. Third, Hillel's teaching was addressed to a stranger—a gentile, one who was not a member of the Jewish community—indicating that he saw it as of broader applicability. Fourth, language is rooted in the cultural milieu, and perhaps words cannot help but be metaphoric, even when the subtext is not meant to be anything more than familiar imagery for the speaker and listener (Lakoff and Johnson 1980). Thus it is perhaps not unanticipated that the word for neighbour used by desert wanderers has echoes of pastoralism (the root of the word for "neighbour" in Leviticus is the same as that for "shepherd"), whereas that used by urban men of learning echoes partnership in the study halls of the Talmud. The replacement of everyman for elitist colleague, then, may be neither a far stretch nor an embarrassed anti-elitism by later translators. Rather, we might see it as an argument that, in fact, one's fellows are indeed everyone else—not just one's work or study colleagues, not just one's proximate neighbours, but all people.

In Christian thought, Jesus' message is universal. Roman Catholicism holds that true Christians are stewards of God's creation, and posses only in common with everyone else. As all people are creatures of God, we are all neighbours deserving attention and respect, and Christians therefore should be ready to share with all in want (Catechism of the Catholic Church Search Engine 2000, #952, #2212). The United Methodist Church's statement on the social community "affirm[s] all persons as equally valuable in the sight of God. ... [Methodists therefore] support the basic rights of all persons to equal access to ... physical protection" (United Methodist Church 2000, Section 3, paragraph 66). The universalism of the golden rule is the implicit foundation for the World Council of Churches (1994) call for church leadership in responding to climatic change and building a sustainable society. Churches in the North are especially enjoined to reduce fossil-fuel energy use. And, as noted above regarding the verse in Leviticus that is the foundation of the golden rule, we need to consider succeeding generations as well.

In fact, people do not tend to be so self-centered that they have no concern for others around them. Depending on the issue, ethical standing is implicitly granted to fewer or more people, closer or farther away, now or in the future. Bamberger (1981, 893) noted, "[o]ur opportunity to practice the golden rule is chiefly in our relations to those who are physically near to us, our literal neighbours. ... Only in recent centuries, especially in our own, has the average person had the knowledge, the opportunity, and the obligation to apply the golden rule on a global scale." The theoretical distinctions between the negative and positive forms, Bamberger goes on, are less important than the actual practice of the rule. There can be no doubt, therefore, that the golden rule is widely held to apply to all people on the planet.

CONCLUSION

Religious institutions have an important role to play in delivering the message of personal responsibility in the matter of climate change. Private automobiles make significant contribution to North America's greenhouse gas emissions. Choice and operation of the personal automobile are entirely within personal discretion, and can be altered without significant effect on quality of life. Economic and enlightened self-interest arguments seem to be inadequate to motivate changes that would reduce individual greenhouse gas emissions. As automobiles have harmful impacts far beyond the individual driver, we need to expand our understanding of neighbourhood to the globe. Most North Americans profess religious allegiance or sentiment. The religious principle of love for neighbour should be a strong motivation for people in making lifestyle choices.

Statements on the environmental crisis by religious organizations do not yet provide many specifics as to individual action, particularly in the realm of automobile use. However, they commonly emphasize the aspect of personal responsibility arising out of religious faith and a need to emphasize the role of human stewardship in creation. The National Conference of Catholic Bishops (1998), for example, expresses concern for the link between the person and the earth. "Our mistreatment of the natural world diminishes our own dignity and sacredness, not only because we are destroying resources that future generations of humans need, but because we are engaging in actions that contradict what it means to be human." They note that Catholic tradition demands protection of the life and dignity of humans and care and defense of creation. The World Council of Churches (1994, 34) notes that a "simple lifestyle of sufficiency encourages cooperation and friendship in community". Its statement on global warming includes a call to the churches "to rediscover Christian teaching on lifestyles of sufficiency in personal lives and institutions" (p. 43). More explicitly, the Evangelical Environmental Network (2000b) signals the place for individual action with a commitment "to work vigorously to protect and heal ... creation". Among the responses the EEN calls for are confession of attitudes devaluing creation, and adoption of stewardship attitudes and actions proceeding from faith. As a principle of faith, the EEN "urge[s] individual Christians and churches to be centers of creation's care and renewal, both delighting in creation as God's gift, and enjoying it as God's provision, in ways which sustain and heal [its] damaged fabric." This paper has pointed to some specific actions that religious institutions might urge upon their adherents, namely that to drive smaller, slower, and shorter is both an ethical choice and a religious imperative. ❑

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Theological and Ethical Dimensions of Addressing Climate Change: Reflections from the World Council of Churches (WCC)

David G. Hallman

The World Council of Churches (WCC) involvement in the issue of climate change stems from our belief that God created and loves this world. We believe that God intends that humans, as an integral part of creation, should live in a wholesome relationship to the rest of creation so as not to cause such destruction that species, ecosystems and indeed large numbers of people are threatened. The churches also see climate change as a profoundly ethical issue. It is being caused largely by the polluting emissions from rich industrialized countries which have accumulated in the atmosphere over the past 150 years whereas the consequences will be suffered disproportionately by the poor of developing nations and by future generations.

Since 1988, the climate change work of the WCC has included consultations on ethical and theological issues, education of its member churches around the world, monitoring the inter-governmental negotiations through the UN, advocacy at national levels, and support for environmental projects of churches in Southern countries. A recent focus of WCC concern is the apparent shift in the post-Kyoto inter-governmental negotiations away from actions to reduce actual emissions in industrialized nations and towards strategies for meeting reduction targets through projects in other countries. In May 2000, the WCC held an international consultation to examine specifically the issue of emissions trading from a perspective of equity. The consultation statement focuses on "The Atmosphere as Global Commons".

OVERVIEW HISTORY OF ECUMENICAL ENGAGEMENT ON SUSTAINABLE COMMUNITY

Over a decade before the term "sustainable development" became popularized through the 1986 Brundtland Commission (World Commission on Environment and Development) the concept of sustainability was being articulated at a World Council of Churches consultation of scientists, theologians and economists in Bucharest in 1974. This 1974 consultation was convened in response to the Club of Rome's report, *The Limits to Growth* which sounded an alarm about how natural resource depletion, pollution, and population growth was placing an intolerable strain on the Earth's resources. What emerged out of the Bucharest discussion on the role of science and technology in the development of human societies was the articulation of a "concept called 'sustainability' - the idea that the world's future requires a vision of development that can be sustained in the long run, both environmentally and economically". The consultation led to the WCC adopting a programme on "just, participatory and sustainable societies" (JPSS). The JPSS framework demonstrated the awareness of the need to link socio-economic justice and ecological sustainability. This has been a recurring theme within the ecumenical community and has been a gift to the broader global community.

The just, participatory and sustainable society framework was expanded in 1983 at the Vancouver Assembly of the WCC with the inauguration of the conciliar process on "justice, peace and integrity of creation" (JPIC). Though the churches have done quite a good job in stressing the linkages among these various global problems, this is not to suggest that we have not had our share of debate within the ecumenical community about the relationship of socio-economic justice and ecological sustainability. The 1990 WCC World Convocation on Justice, Peace and Integrity of Creation in Seoul and the lead up to it stands out as one of the points in our history where this discussion was particularly vigorous. There were criticisms, particularly from persons involved in economic justice work, that the rising priority on environmental concerns was a northern and largely middle-class diversion of the churches' attention from the more critical concerns of hunger, poverty, and racial injustice. The Seoul JPIC Convocation did nonetheless make a significant step forward in the articulation of the 10 affirmations which, together with the analyses on which they are based, provide a clearer elaboration than we had had regarding, on the one hand, the inter-relatedness of economic inequity, militarism, ecological destruction, and racial injustice and, on the other hand, the theological, ethical and spiritual basis for affirming and sustaining life in its fullness.

The UN Conference on Environment and Development (UNCED) held in Rio in June 1992 was a high point in ecumenical involvement in issues of sustainability and in interaction with the broader global community. In addition to representatives from other faith groups, the WCC was able to provide a substantial profile of religious communities at UNCED witnessing to our belief that the issues being addressed by the Earth Summit had ethical, spiritual and theological dimensions which could not be ignored. (UNCED provided the initial conception of a theological resource which later resulted in the WCC book *Ecotheology: Voices from North and South*).

More explicit work on the theme of sustainability was done in 1993 when the WCC-related Visser 't Hooft organization sponsored a consultation entitled *Sustainable Growth: A Contradiction in Terms?* A central focus of that consultation and the resulting booklet was the destructive and inequitable impact of the global economic system which emphasizes economic growth at all costs. The participants suggested that the term and concept of "sustainable development" was in risk of being eviscerated of its transformative potency by being expanded to include sustainable economic growth. In fact, this is precisely what we have seen in the documents that governments adopted at the Rio Earth Summit and most of the UN conferences since. More recently, the WCC has begun using the concept of "sustainable community" seeing it as a more helpful image because of its focus on the nurturing of relationships within community which should be the intent of economic and social policies and practices.

Within this historical context, the ecumenical work on climate change has emerged as a specific focus for the broader concerns about the links between economics and environment. The WCC work has included the support of regional workshops in regions around the world, consultations and resources which seek to analyse the issue from a theological and ethical perspective, advocacy at national levels and within the UN negotiations on climate change treaties, etc.

CLIMATE CHANGE AS AN ISSUE OF JUSTICE

No one would deny the very considerable benefits to human well-being that have resulted from scientific and economic development over the past century. But the western economic development model has also bequeathed destructive socio-economic and environmental legacies, human-induced climate change being one of them. The ethical dimensions of climate change come to the fore as we recognize that human choices have led to the propagation of the western development model with its unintended negative consequences and human choices can change it for the better. This human responsibility is one dimension of the ethics of climate change and is supplemented by the fact that the problem is caused largely by those who are rich and powerful in the world and the consequences will be suffered the most by those who are poor, politically weak, or voiceless as a function of being yet unborn. In a World Council of Churches (WCC) statement delivered to the plenary at the Kyoto Climate Conference in December 1997, we integrated these two ethical dimensions and spoke of climate change as an issue of justice. (The WCC statement to the High-Level Segment of the Kyoto Climate Summit is attached as Appendix A).

The WCC statement in Kyoto articulated a number of implications of viewing climate change as an issue of justice. Justice means that as individuals and as societies, particularly in the over-developed parts of the world, we must be held responsible for the destructive impact of our actions which are leading to climate change and threatening vulnerable human communities, other species and broader ecosystems. Justice implies that we must be accountable for promises that we make to limit the emissions of greenhouse gases. Justice demands truth and an end to the campaigns of misinformation whose purpose is to protect powerful economic interests. Justice requires honesty in international relations so that rich oil-producing countries are not allowed to masquerade their interests by appealing to their technical status as belonging to the category referred to as "developing nations".

In addition to these dimensions which we might refer to as retributive justice, there is also a significant distributive justice aspect to the climate change issue. Justice means an equitable sharing of access to the Earth's resources and the right to use resources for ecologically sustainable human development. The major North/South conflict in the international negotiations on climate change has stemmed from the concern among developing nations that global treaties might place restrictions on their economic development and thus hamper their ability to deal with the poverty in their countries. They see this possibility as unjust because the climate change problem has been caused by the industrialized nations which have grown rich pursuing a development model powered by fossil fuels. The poorer nations have thus argued that they must be allowed to develop so that their people can enjoy a good quality of life. Ethicist Henry Shue has proposed the helpful distinction between the "luxury emissions" of the rich which are produced in support of lifestyles of consumption and transportation and the "survival emissions" of the poor who use fossil fuels primarily for the essentials of food and shelter.

In the final hours of negotiations in Kyoto, India and China provided a dramatic illustration of the distributive justice dimension of the climate change issue. The point being debated was a concept called "emissions trading". The industrialized countries wanted the Kyoto Protocol to include provision allowing them to buy and sell emissions credits. A credit would be the difference between a country's actual emissions level and the level which they would be allowed to emit under the treaty. Theoretically, emissions trading is supposed to lead to an overall reduction in emissions by assigning a market value to emissions credits whereby more efficient countries could receive money by selling their credits to more polluting countries who would need them in order to meet their target. Using the market in this way is supposed to be beneficial environmentally by making it costly to pollute and thus induce countries to reduce their emissions levels.

There is considerable skepticism about emissions trading among some observers of the Kyoto Protocol because it is the former Eastern Bloc countries who, at least in the near future, will have credits to sell not because they are more efficient but because their economies have collapsed and many polluting industries have closed since the base-line year of 1990 against which the reduction targets are set. The buyers of these credits will likely be industrialized countries such as the United States, Japan, Canada and Australia and some fear that the net impact would be to diminish the pressure on these countries to make changes that would reduce greenhouse gas emissions levels in their own countries.

The objections being voiced by India and China during the Kyoto negotiations were related to these concerns but stated at a more general level using the terminology of ethics in viewing the atmosphere as a global commons. They were upset that the industrialized countries were preparing to launch a bartering system with a commodity which they didn't own i.e. the atmosphere. India demanded that before emissions trading is allowed, there needed to be agreement on "an equitable distribution of emissions entitlements", that is an agreement on how much emissions each person should be allowed. Their basic ethical foundation was that all members of the human community should have the same right to a sustainable quality of life. India argued that only when a global agreement is reached on emissions entitlements, can a system be devised for assigning monetary value and initiating an emissions trading system. China articulated the issue as one of human rights. A compromise was arranged by the chairman that avoided the collapse of the negotiations by basically postponing the hard decisions on emissions trading until a future meeting. The drama of that debate at 3am on the last night of the negotiations illustrated that the ethical dimensions of the climate change issue, both in terms of retributive and distributive justice, are not hypothetical but carry very real force in the economic and political hard-ball of international negotiations.

THE ATMOSPHERE AS A GLOBAL COMMONS

Concerned that little work is being done internationally to examine the ethical dimensions of emissions trading, the WCC has initiated a research/analysis project which focuses on issues of equity as they relate to emissions trading within the context of examining implications of the atmosphere as a global commons. The WCC views with concern the proposals for international emissions trading systems as a means for industrialised countries to reach reduction targets by purchasing credits from other countries. Taking a long-term perspective, the WCC sees a variety of serious ethical issues related to equitable access to the global atmospheric commons, de facto assumptions of emissions entitlements for industrialised countries based on historical patterns, implications for countries of the economic South as they are pressured to accept reduction targets in future commitment periods under the Kyoto Protocol, etc.

The WCC commissioned background papers to address various aspects of the issue of emission trading within a broad ethical and theological framework. Writers of these papers included:

- Hermann Ott and Wolfgang Sachs of the Wuppertal Institute, Germany;
- Anil Agarwal and Anju Sharma of the Centre for Science and Environment in India;
- Jaap van der Sar of the Dutch churches in collaboration with Herman Verhagen of Ecooperation in the Netherlands;
- Charles Sampford, Foundation Professor of Law, Director Key Centre for Law, Justice and Governance, Australia;
- Jesse Mugambi, Dept. of Religious Studies, University of Nairobi, Kenya;
- Carol Robb, San Fransisco Theological Seminary, USA.

The papers formed the initial input at an international consultation held in Saskatoon, Canada (May 9-14, 2000). Out of the event, a statement on ethical and theological reflections related to equity and emissions trading was prepared which will serve as an advocacy tool for churches to use with their governments prior to the 6th Session of the Conference of the Parties to the UN Framework Convention on Climate Change (The Hague, Nov. 13-24, 2000). A copy of the overview of the statement is attached as Appendix B. ❑

Appendix A

STATEMENT BY THE WORLD COUNCIL OF CHURCHES TO THE HIGH LEVEL SEGMENT OF THE THIRD SESSION OF THE CONFERENCE OF THE PARTIES (COP3) TO THE UN FRAMEWORK CONVENTION ON CLIMATE CHANGE

Kyoto, Japan
December 9, 1997

Mr. President, Distinguished Delegates, Observers,

We recognise that the COP3 negotiations are at a difficult point. We make this statement on behalf of the World Council of Churches with a combination of humility and prayer, wanting to assist the process and yet needing to speak the truth as we discern it.

For us in the World Council of Churches, the core of the COP3 agenda is justice.

Justice means being held responsible for one's actions.

The rich of the world, through promotion of the current economic model, have been and continue to be responsible for the vast majority of emissions causing human-produced climate change but seem unwilling to honestly acknowledge that responsibility and translate it into action. It is ironic that countries which exult in their domestic legal principles feel themselves above the law when it comes to their international obligations on climate change.

Justice means being held accountable for promises you make.

The rich of the world have broken their Rio promise to stabilise emissions by 2000 at 1990 levels and yet seem to exhibit no embarrassment at their failure.

Justice means being held responsible for the suffering you cause to others.

Small island states, millions of environmental refugees, and future generations will suffer as a result of the callous exploitation of the Earth's resources by the rich.

Justice means being held accountable for abuse of power.

Human societies, particularly in the over-developed countries, are damaging the environment through climate change with little respect for the inherent worth of other species which we believe to be loved by God as are we.

Justice means an equitable sharing of the Earth's resources.

Millions of people lack the necessities for a decent quality of life. It is the height of arrogance to propose that restrictive commitments be placed on the poor to make up for the delinquencies of the rich. Over-consumption of the rich and poverty of the poor must both be eliminated to ensure quality of life for all.

Justice demands truth.

Destructive misinformation campaigns are being used by groups with powerful economic self-interest with the intention of preventing meaningful action on climate change.

Justice requires honesty.

The world is not so easily divided into the rich North and the poor South as we used to think. There are a few wealthy and powerful countries and elites within the category referred to as developing countries who sometimes misuse this classification of nations to disguise their economic self-interest.

God's justice is strict but it is not cruel. We are all here in Kyoto as brothers and sisters equal before God within the community of creation - a creation which we all want to be healthy and thriving for future generations. In affirmation of the goodness of creation (Genesis1:25), God beckons us to respect all forms of life. In what we do at COP3, we must not betray life.

Confidence-building measures are needed so that together we can reduce the threat of climate change:

- Industrialised countries must demonstrate, in the near future, real and significant reductions in domestic greenhouse gas emissions which many studies have shown to be possible with a considerable net benefit to their economies.
- Though developing countries should not be subject to formal emissions limitation commitments yet, many of them are pursuing measures and can continue their efforts to become more energy-efficient and to limit greenhouse gas emissions.
- The sharing of finance and technological resources is needed but it is also very important to exchange experiences from both South and North including those of indigenous cultures, women's organisations and others which can offer lessons and tools for learning to live in a socially just, equitable and ecologically sustainable manner.

In these remaining days of COP3, let us shift our energies away from trying to figure out how to attain the minimum and channel them instead toward creative risk-taking options for accomplishing the maximum. Thank you.

Appendix B

THE ATMOSPHERE AS A GLOBAL COMMONS: RESPONSIBLE CARING AND EQUITABLE SHARING

A Justice Statement regarding Climate Change from the World Council of Churches (WCC)

Prepared in anticipation of the 6th Session of the Conference of the Parties (COP6)
to the UN Framework Convention on Climate Change
to be held in The Hague, Netherlands November 2000

OVERVIEW

The atmosphere is a global commons. It envelops the Earth, nurturing and protecting life. The atmosphere belongs to no one. It is to be shared by everyone, today and in the future. Economic and political powers can not be allowed to impair the health of the atmosphere nor claim possession of it.

Human societies are changing the chemical composition of the atmosphere through the excessive use of fossil fuels. Humans and other members of the life community are already suffering from climatic changes and scientific projections point to an increase in the number of those affected and the severity of such suffering adversely affecting health, food security and habitation.

The wealthier countries with high per capita emissions levels have precipitated the climate change crisis. They have the moral responsibility to substantially reduce their own emissions.

Wealthy polluting countries should not be allowed to buy their way out of the problem through paying for projects in other countries.

Over the years since the adoption of the Climate Change Convention at the Rio Earth Summit in 1992, attention has shifted away from a priority on emissions reduction actions in the richer polluting countries and toward strategies for those countries to purchase low-cost reduction credits in other countries.

Emissions trading under the Kyoto Protocol would violate the criterion of ecological effectiveness because it would not ensure a reduction in actual emissions.

Trading mechanisms such as proposed under the Clean Development Mechanism would pose major issues of equity and justice. Establishing the system based on historical emissions patterns reinforces a history of inequity between rich and poor in terms of resource exploitation and use of ecological space in the global atmospheric commons.

The Clean Development Mechanism risks exacerbating inequities between rich and poor. The richer countries, in order to meet their reduction targets, would be able to mop up the cheap reduction options from developing countries. This would leave only more expensive reduction strategies for the poorer countries when it is time for them to take on commitments in the future.

The Clean Development Mechanism could further lock the poorer countries into the carbon path. Also, poorer nations in Africa would be severely disadvantaged through the Clean Development Mechanism. Because of their poverty and low per capita emissions, they would not attract investments from industrialised countries.

The threat of climate change forces us to seek alternate paths in order to stabilise the concentrations of CO_2 in the atmosphere. A non-carbon energy future is both a necessity and a realisable possibility.

An alternate approach which would be more sustainable and equitable could be a Global Atmospheric Commons Model which would be based on an equitable allocation of emissions rights such as the per capita convergence (i.e. long term sustainable) level. Countries which use the global atmospheric commons in excess of the convergence level would have to pay a user penalty into a Global Atmospheric Commons Fund. The fund would assist impoverished countries and those with economies in transition to move towards a non-carbon economy focusing on renewable energy sources such as solar, biomass, wind and small scale hydroelectric.

All humankind is made in the Image and likeness of God & all of nature bears the marks of God. This demands (requires) of us to adopt the guiding principle of equity. God's inheritance is for the communal body, a concept that includes all of nature.

The destruction of the global atmosphere is a sin against God. True forgiveness is available from God but only after true repentance by the sinner. True repentance requires a conversion of the heart and a transformation of behaviour. Only then can true forgiveness be experienced. Countries with high emissions need a conversion of the heart and demonstrably new behaviour before they seek forgiveness.

Recommendations for COP6

1. Refocus climate change negotiations on to options that meet the criteria of environmental effectiveness, equity, responsibility and economic efficiency with the priority being emissions reduction strategies in the high per capita polluting countries.
2. If an emissions trading system is pursued, it must include:

- Equitable emissions allocations as the basis
- Measurable criteria to ensure trading is supplemental to domestic action
- A limit on the amount that can be creditted toward domestic target
- A fee to meet administration costs and adaptation needs for most vulnerable
- An effective verification and compliance mechanism

3. If the Clean Development Mechanism is pursued, it must:

- Be based on principles of equitable allocations
- Be directed to projects focused on non-carbon renewable energy technology

Session E2

CIVIC ENGAGEMENT IN CLIMATE CHANGE 4: SCENARIOS AS COMMUNICATION TOOLS

Citizens' Perspectives of Climate Change in Europe: Perceived Barriers to Action
Susanne Stoll
Swiss Federal Institute for Environmental Science and Technology

Communicating Uncertainties: Approaches and Experiences from Switzerland
Martin Büssenschütt and Claudia Pahl-Wostl
Swiss Federal Institute of Environmental Science and Technology

A Coevolutionary Approach to Climate Change Impact Assessment in the UK
Irene Lorenzoni,[1] Andrew Jordan,[1] R.Kerry Turner,[1] Tim O'Riordan[1] and Mike Hulme[2]
1. Centre for Social and Economic Research on the Global Environment, University of East Anglia
2. Climatic Research Unit, University of East Anglia

Using Integrated Assessment Models in Conversations with the Public:
ULYSSES in Vancouver (Canada)
Pamela Robinson
Environment Canada

Citizens' Perspectives of Climate Change in Europe: Perceived Barriers to Action

Susanne Stoll

Groups of European citizens looked at models of possible consequences of climate change. Respondents were alarmed about the consequences of high energy futures, and mollified by images of low energy futures. Yet they also erected a series of psychological barriers to justify why they should not act to mitigate climate change. From the viewpoint of changing their lifestyles of material comfort and high energy dependence, they regarded the consequences of possible behavioural shift arising from the need to meet mitigation measures as more daunting. To overcome the dissonance created in their minds they created a number of socio-psychological denial mechanisms.

INTRODUCTION

This paper assesses how groups of informed citizens judge their personal responsibility for climate change mitigation through the lens of the IA (Integrated Assessment) focus group. In particular, it looks at a number of psychological devices that people select to justify the emotional dissonances they can experience when confronted with the challenge of changing much preferred consumption patterns and lifestyles in the course of reducing greenhouse gases.

The research reported on below suggests that denial over the necessity to adjust behaviour and lifestyle patterns is a function of discourse as it is of more fundamental personal, social and psychological influences that are not readily shifted around by language or by exhortation unless the process of awareness raising is prolonged and set in constructive engagement with a wider array of socially sanctioned moral norms.

This paper has the objectives to examine why a cross-section of European citizens appear to be unable to act in accord with their preference for a low energy future which they regard as an essential antidote to climate change and to explore underlying socio-psychological theories in order to explain why such barriers to civic responsiveness exist, so as to inform policy makers as to appropriate consequences for future strategy in a participatory democracy.

METHODOLOGY AND IA FOCUS GROUPS

The findings that follow come from the Swiss ICRA (Integrated Climate Risk Assessment) project and the European project ULYSSES. ICRA is one of 15 sub-projects of the interdiscliplinary project CLEAR (Climate and Environment in Alpine Regions) funded by Swiss National Science Foundation. CLEAR is an effort to increase understanding of the potential impacts of climate change for Switzerland and to provide policy relevant information which can support decision-making.

The method for analysis selected here was the conduct of IA focus groups. The "focus group" approach combines two social scientific research methods. One is the *focused* interview, in which an interviewer elicits information on a topic. The other is the *group* discussion, in which a small, relatively heterogeneous group of people discuss a topic raised by a skilled moderator (Dürrenberger et al., 1997). The point of the exercise lies in the ability to observe social processes of opinion formation in which some new information is taken into account (Jaeger et al., 2000).

In IA focus groups the common stimulus is given by exposure to an interactive IA-computer model or a similar piece of information. In the present case, the computer models used included IMPACTS and OPTIONS (these models have been developed by C. Pahl, C. Schlumpf and other) as well as the TARGETS, IMAGE and POLESTAR models also used in the ULYSSES project. The IA focus groups meet several times in order to reach a more in-depth discussion of the topic under consideration. Five meetings of two and a half hours each were typical (Jaeger et al., 2000).

The evidence was analyzed in a more structured way than it is usual with focus groups. The group discussions were videotaped and the tapes transcribed. A set of topics of primary interest for the present investigation was designed and the portions of the overall conversation relating to any one of these topics were transcribed on computer files. Next, a list of categories of possible statements was established and for each item a code was defined. Then the transcribed conversations were labelled with these codes in the Atlas software for qualitative content analysis. With this technique, it was possible to scan all transcripts for specific topics (Jaeger et al., 2000).

Besides the transcripts, further output of the IA focus groups included minutes, responses to collectively generated collages, citizen reports and individual questionnaires. The questionnaires were filled out before and after the interaction with the IA computer models, so that any potential change of knowledge and attitudes could be recognised.

Citizen report

Box 1 summarizes the key issues discussed by the IA focus groups in the process of reaching common understanding of all the main themes raised. The aim was to enable participants to synthesize contrasting and conflicting evidence, wherever possible. This process also assists policy analysts to improve their own understanding of how representative panels of citizens think about the implications of climate change, possible desirable futures, and what might be their responsibility in their future.

Box 1 The citizens` report structure:

1. Do you think there is a problem of climate change? If yes, then what is the problem?
2. Given this, how should we live in 30 years` time here (e.g. in Zurich)?
3. What should be done so that we can get there?
4. Given this, how much energy use compared to today is appropriate in total, and in the different sectors (e.g., transport, households)?
5. Who should take action? And when?
6. What do you think will be difficulties in getting there (barriers of action)?
7. If you have anything else you want to note down, please do so.

Collages

In this study, the collage was used as a pictorial representation of various images associated with possible outcomes of climate and energy futures. In order to produce the collages the groups were split in two halves in the first session. One sub-group was asked to think about how the region in which the participants live might look like thirty years from now if energy use would develop more or less as in the past – a business-as-usual (BAU-) scenario (high-energy future). The other sub-group was given a similar task, this time with the constraint that energy use would be reduced in the order of magnitude of 30-50 per cent in comparison with the present – a scenario of drastic reduction in energy use. The sub-groups then presented their collages to each other.

The outcome is that European Citizens generally perceive climate change risks as a serious issue (along with other environmental problems). Accordingly, they often perceive a world characterized by high levels of energy use as rather unattractive if not nightmarish. Consequently a world characterized by low levels of energy use is often perceived as an attractive option (Jaeger et al., 2000).

The images linked to the low energy scenario were interpreted as being friendly to people, animals, biota generally, and to vulnerable groups such as women and children. The evidence suggests that participants tended to regard low energy futures as highly desirable for the planet and its human family across a whole range of avoidable catastrophes.

A high-energy scenario is associated with images of catastrophes, monsters, war, destroyed nature and chaos generally. Again it was a remarkable consistency amongst all the participants over a coherent set of perceptions of crises linked to high-energy futures.

This apparent consensus over the "goodness" of low-energy futures revealed a fundamental contradiction. This was that almost nobody was prepared to take the kinds of personal actions deemed necessary to achieve such a future, and modulated climate change. To explain this we follow a two-fold approach. First we review theoretical, mostly socio-psychological, approaches to explain a big part of this discrepancy. Secondly, through quotations arising from the IA focus groups, we show how denial can coherently be maintained.

SOCIO-PSYCHOLOGICAL THEORIES OF DISSONANCE AND DENIAL

It is well established in socio-psychological theory that attitudes help a person to mediate between the inner demands of the self and signals arising from the outside world (Katz, 1960; McGuire, 1969; Pennigton et al., 1999). These external cues may relate to influences of social networks, and views of the appropriateness of lifestyle and consumption behaviour. Both social norms and cultural norms provide significant biases for such attitudes. But so, too, does personal experience, and the "certainty arrays" of co-ordinated beliefs that are formed to assist in their response to complex, and possibly intimidating, requirements.

The pattern of mediation between self and social context is assisted by four functions, namely the *adaptive function, the self-expressive function, the ego-defensive function and the knowledge- function.* Adaptation is dependent on forming positive associations with persons or outlooks with which the individual shares a sense of common identification. This function is hedonistic in that it serves the purpose of increasing satisfaction or pleasure and avoiding punishment or pain. Self-expression is displayed by the need to show to others about one's inner values or feelings, i.e. to be externally self-conscious. One aspect of this is the expression of self-identity, namely a wish to be in a state of inner control, yet externally appreciated. Ego-defensiveness serves to protect people from their own inconsistencies and their negative feelings towards other people. With respect to self-protection, attitudes may serve to maintain self-image. Knowledge-processing allows people to process and order information into coherent and organized patterns in order to simplify and understand complex and possibly conflicting issues (Pennigton et al., 1999, 75).

For the most part, all these functions seek to establish a sense of consistency, and hence inner calm (Heider, 1946; Festinger, 1957; Pennigton et al., 1999). Research on schematic patterns in social psychology (Taylor and Fiske, 1981) indicates that both the encoding and the retrieval of information are often guided by personal desire to maintain cognitive consistency.

The lack of consistency is the state of *dissonance*. In general individuals experiencing dissonance seek to resolve it, deny it, or displace it. We will see from the IA focus group research reported on below that, for the most part, denial or displacement act powerfully to maintain the gap between attitude and behaviour with regard to climate change norms.

From the brief review of the other functions relating to attitude formation, it will be seen that reorganizing knowledge, changing social identification, appealing to self image and enabling constructive adaptation may all have to be involved if attitudes and behaviour towards climate change are to resonate in a coherent manner.

Attitudes differ from behaviour for a number of well-known reasons. One explanation is that offered from the evidence presented so far, namely that attitudes to climate change can relate to a general societal norm, while behaviour rests with specific individual responsibility. Another, more common interpretation, is that attitudes cover a vast array of cognitive processes and compositions that remain chaotically in conflict for the most part, except when contradictions have to be confronted. Hillmann (1989, 55) summarises the wide basis for complexity in attitudinal patterning

> Conceptions about value, meaning, purpose and utility, preferences, predilections, and interests, conceptions about taste, pretensions and wishes, the aspirations of rewards, gains, profits and the heightening of one's ego, avoidance of penalties, disadvantages, costs and the loss of one's ego…

Where behaviour is not routine, values enter (Lantermann and Döring-Seipel, 1990). Such values are selected for consistency and support, namely by coinciding behaviour with underlying moral norms. Such norms shape the justification for action or inaction. According to Wortmann, et al., (1993, 81), the following dimensions of attitude contribute to environmentally dependent behaviour:

- the need for personal comfort
- the belief in technological solutions
- the belief in personal contribution to mitigation
- the demand for a justifiable relationship between personal costs and social gains
- the acceptance that there is indeed a crisis

Furthermore internal inconsistencies can occur between verbal expressions of behaviour in one setting and actual behaviour in another (Tampe-Oloff, 1986). This distinction can also be influenced by emotional unease over any discrepancy. To avoid this unease, people look for cues to justify continued behaviour in the face of a socialized moral norm to the contrary.

One area of consistency analyzed here lies in the possible disjunction between a personal preference for a particular lifestyle, consumption habit, or behavioural choice and the need to respond effectively to climate change mitigation strategies. In short, people may profess anxiety over climate change, but be faced with internal resentment or even denial over what they cannot accept as a justifiable change in behaviour (e.g. to travel by public transport, ride a bike in the rain or invest in high cost domestic insulation). The research reported on below suggests nine ways in which this denial may occur:

- metaphor of displaced commitment – *I protect the environment in other ways*
- to condemn the accuser – *You have no right to challenge me*
- denial of responsibility – *I am not the main cause of this problem*
- rejection of blame – *I have done nothing so wrong as to be destructive*
- ignorance – *I simply don't know the consequences of my actions*
- powerlessness – *I am only an infinitesimal being in the order of things*
- fabricated constraints – *there are too many impediments*
- "After the flood" – *what is the future doing for me?*
- comfort – *it is too difficult for me to change my behaviour* (Schahn, 1993, 59-60).

From an emotional viewpoint such responses help to assuage guilt, to reinforce victim status, to justify resentment or anger, and to emphasise the negative feelings towards disliked behaviour (e.g. the disagreeable qualities of relying on public transport and the loss of social prestige involved).

A common theme throughout this denial processing, is that of the well-known *tragedy-of-the-commons* (Hardin, 1968).

> In tragedy-of-the-commons situations, behaviour that makes sense from the individual point of view, when repeated by enough individuals, ultimately proves disastrous to society. (…) Each individual gains,

> financially or otherwise, by consuming the natural resource. Each, furthermore, sees little harm in doing so since the resource is so huge in size and their impact on it is so small (Gardner and Stern, 1996, 23).

Based on this theoretical perspective, and especially taking into account the "barriers of denial" listed above, we hypothesise that denial in the face of political and moral exhortations to change behaviour in the cause of mitigating climate change is reinforced by the following:

- an unwillingness to give up customary habits and favoured lifestyles which are closely associated with a sense of self-identity (the "comfort" interpretation)
- the construction of attitude and behaviour connections that regard any costs to the self as greater than the benefits to others (the "tragedy-of-the-commons" interpretation)
- a lack of acceptance that the climate problem is as serious as made out, and that a belief in any case it can be resolved by recourse to technological and regulatory innovation (the "managerial-fix" interpretation).

These three "interpretations" are closely interlinked. The richness of the data set reveals this to a remarkable extent. The separation of these interpretations reported below is largely to clarify nuances of outlook. It is also worth bearing in mind that well facilitated focus groups using a range of approaches used in this study can lead to a healthy reinforcement of views amongst participants, who feel comfortable about gradually maneuvering into consistency.

FINDINGS: PERCEIVED BARRIERS TO ACTION

What follows is a selection of quotations arising from the IA focus groups. These illustrate the three "interpretations" that resonate with the literature, but they actually emerged from the discussions, spontaneously and coherently. While the literature provides a framework, the evidence we use below is displayed in the form of representative quotations reflecting the aggregated outlook of citizens responding to a well-designed range of stimuli to offer their own authentic perspectives.

The comfort interpretation

The most powerful zone for denial was the perceived unwillingness to abandon what appeared as personal comfort and lifestyle-selected consumption and behaviour in the name of climate change mitigation. Participants regarded consumption as a social as well as an economic good, so found it too difficult to accept that any personal sacrifices would be worth the social gain.

> I find it so hard to think differently because it really interferes with your life. If, for instance, you have to rely on public means of transport and depend on their schedules … I think that's the main problem: you have to give up quite a bit of your comfort (Group 4, Zurich).

> Perhaps we are a bit too lazy, perhaps society is too indolent to engage in environmental issues, to orient individual lives by ecological criteria, (…) to save energy. And as long as the big collapse has not yet occurred, as long as the catastrophe has not yet approached enough, people just pursue their comfort, unless there are financial incentives (Group 6, Sissach)

> You cannot change things unless you begin in your daily life. As has been said already, you should become active at all levels, and I think, ultimately daily life has to change if the whole is to be changed. This is certainly a key argument: people are obviously not prepared – or meanwhile they are a bit prepared but too little – to change things in their private lives (Group 6, Sissach)

The tragedy-of-the-commons interpretation

The quotations that follow reflect the findings reported by Wortmann et al., 1993, and Schahn, 1993, namely that the cost to individual freedom to choose and to be happy in an economy of beneficence are too great to contemplate for an uncertain climate future. One way of coping with this is to believe in the insignificance of individual action to change the order of things. Another is to look to others to adopt the same unwillingness to act. It is tempting to blame the collective tardiness in adopting climate change mitigating behaviour as something through which all people reluctantly share. One noticeable feature of this response is to emphasise the relative insignificance of the behaviour that has to be changed.

Denial of responsibility and powerlessness

And additionally, I find it an interesting observation that we use to rather quickly conclude: I alone can do nothing, I can achieve something only if the others join (Group 8, Liestal).

A dialogue
Hanna: There are relatively few actual possibilities to practically do something if you feel concerned. They can't tell you that much what really to do. To consider not turning on your stereo set on account of its energy consumption seems a bit ridiculous. There must be so many possibilities at other levels. Somehow you find yourself in a vacuum.

Lena: Helpless.

Balthasar: You have to gather very much information. But sometimes I find us already almost hypersensitive to those things. Actually, nothing should be in supply any more that is so environmentally harmful. I am convinced that theoretically this is realizable. Just the means are not yet available. Or it's the wrong people that have them at their avail (Group 16, Engelberg)

As long as the USA doesn't do anything ... you can't force things. And yet someone has to start. Not necessarily with an extreme step, (...) but a model is needed in the context of which other countries might start as well. (...) You cannot expect all countries to start simultaneously. Even if you look at international law: you can't force anybody to respect the rules. (...) I am simply a bit disappointed that countries of so much relevance lag so much behind and don't even understand it. If only those countries with their enormous populations concerned could make this clear...(Group 11, Lucerne)

After the flood: personal freedom to choose

A dialogue
Fabian: Standing in the way of ecological measures is lacking insight, individualism and egoism.

Renaldo: Yes. Individualism, personal freedom, which in our society is one of the highest goods. Or is seen as one of the highest goods. Free way for free citizens (Group 12, Lucerne)

After the flood: ignorance and powerlessness

A dialogue
Change is difficult since we are so accustomed to things as they are, to consumption, to food and drink. You don't think any more about what you do to nature.

Gerda: We just consume.

Jean: Yes, we just consume. Ok, this object is cool – actually it is toxic when burned, but we don't care anyway, as we don't exactly know what effects we cause. Information is rather vague, and so you don't really know, I don't really know, we are somehow helpless. If we took every problem serious, we would become permanently depressed (Group 4, Zurich)

After the flood: rejection of blame

The cause is the human being as such. His or her needs, generated by some publicity or his or her personal

> environment (Group 12, Lucerne)
>
> The mobility mania is just a symptom, the cause is our society. Our society orients by a certain rationale, e.g. by certain ideals of beauty, by ideals about how to spend vacations, what to do to be 'in', what mountain bike to ride. I think, the cause could perhaps be found at school, in education (Group 12, Lucerne).

The managerial-fix interpretation

The faith in some form of managerial fix is always a comfortable zone for denial. This is usually found in the more technocentrically orientated citizens, but from the evidence from these IA focus groups, this perspective was widespread, both as a hope and as an expectation.

The belief in technological solutions

> Max: He had quite a good idea. Now, if energy saving devices became trendy. Or if energy saving itself became trendy. If electric cars or the Smart car became trendy. (Group 17, Engelberg)
>
> I am content with the possibility to buy one detergent, I don't need fifty different products in supply. But then I require this one detergent to be produced by these intelligent people, the chemists etc., in a way that I'm not additionally forced to dose it as minimally as possible so as not to stress the environment. This should be the task of them up there and I should be able to rely on them (Group 8, Liestal).
>
> It is interesting to contrast the image of a managerial fix with an image of learning in a civic society.

The belief in personal contribution

> If people felt closer to each other, if they treated each other in a different way .... This would be advantageous for nature as well (Group 8, Liestal)
>
> Each individual is not prepared to do without certain conveniences. So all individuals together do not succeed in creating political pressure (...) In our political system, substantial changes are realised via vote. But this will be of no use as long as not everybody becomes active and recognises certain problems, thus being prepared to support political action. It is very unlikely that today a majority would vote in favour of a bill for a continuous increase in energy prices. If everybody understands and personally begins to change things, a political majority becomes realisable. Such is our system (Horst, Group 17, Engelberg)

CONCLUSIONS

The denials described above are therapeutic strategies to deal with the pain involved in dissonance. They are not easily set aside unless the perception of gains and losses is substantially reversed. The tragedy-of-the-commons outlook also creates a powerful sense of awaiting others to act first before individual sacrifices are regarded as worthwhile. Alternatively, the danger of feeling inconsequential rises to the surface of the mind when matters of comfort or self-identity are apparently threatened, or at least challenged.

The findings from this study reveal both a coherence and a rationality to dissonance and denial that will not make it easy for democracies to gain early consent for tough climate change mitigation measures. Indeed, this analysis suggests a level of sophistication and cohesion in socio-psychological reactions that will prove difficult to alter, unless very wide-ranging policy responses are integrated over a prolonged period of time.

The application of socio-psychological theories provide a rich interpretation as to why attitudes do not readily fit with behaviour. Further research extending these theories by building on the procedures reported on in this paper, using a wider array of participants, and taking place in other political cultures, should reveal more fundamentally the nature of the barriers to citizen action. The results of these studies need to be carefully translated into appropriate policy action through dialogue with policy-makers and decision-takers. In this way a blend of socio-psychological and political perspectives may provide the most relevant theoretical and policy framework.❑

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Communicating Uncertainties: Approaches and Experiences from Switzerland

Martin Büssenschütt and Claudia Pahl-Wostl

One of the products of a recent national research project on climate change in Switzerland was an Internet-based information platform. It was designed to communicate not only the scientific results but also the uncertainties involved. The experiences in educational settings and in focus groups demonstrated that users have major difficulties with dealing with uncertainties. However, first signs of a changing perception of science can also be identified. In order to further support public perception of uncertainty, a new tool for educational purposes is being designed, focussing on decision-making and acting under uncertainty.

INTRODUCTION

Integrated assessment of climate change has a long tradition in particular regarding the global scale. However, it is meanwhile evident that regional action will be decisive for action at the global scale. Morgan and Dowlatabadi (1996) summarised insights from many years of integrated assessment on global climate change. In particular, they emphasised that many decisions will be made by the individual choices of millions of organisations and citizens, and these will be driven by local interests and conditions. The climate decision-makers are diffuse groups spread all over the globe who will make a number of sequential climate-related decisions that are primarily driven by local non-climate considerations. This implies that an embedding of climate related decisions into a wider range of societal concerns is a prerequisite for a successful climate policy at a regional scale. It also implies that structuring the communication interface between science and society is an essential task to foster the debate on climate change topics.

Uncertainties are a crucial element when risks and options of climate change are evaluated (Pahl-Wostl 1998). Different approaches were chosen to account for these uncertainties in integrated assessment models at the global scale (Dowlatabadi 1995, Van Asselt and Rotmans 1995). Accounting for uncertainties in the public debate is still a major topic of general concern.

Within a recent national research project on climate change in Switzerland, a new approach to integrated assessment modelling has been developed. It involved citizen focus groups for the participatory integrated assessment of regional climate change. In this approach, decision making is studied as a process of social learning between citizens, scientific experts and policymakers. It involves the construction of a specific kind of communication tools that can be used in a participatory integrated assessment. To our knowledge, this is the first integrated project where such an approach was chosen.

AN INFORMATION PLATFORM ON CLIMATE CHANGE IN SWITZERLAND

The CLEAR Project

The Swiss national research project CLEAR (Climate and Environment in Alpine Regions) focused on the regional aspect of climate change and on the specific impacts that have to be expected for Switzerland. It comprised 15 subprojects from the natural, political, economical and social sciences. One important aspect was to study public perception of climate change and the uncertainties involved with the help of focus groups (cf. also Stoll 2000, in these proceedings).

An integral part of CLEAR was the design and implementation of an information platform for laypersons. The modules of this Internet-based platform integrate the results from the various disciplinary subprojects and display them in a generally intelligible manner. Texts are supported by images and graphs; animations, video clips and interactive simulations add to the attractiveness of the modules. From the very beginning, uncertainties were considered important to be included in the information resources for laypersons.

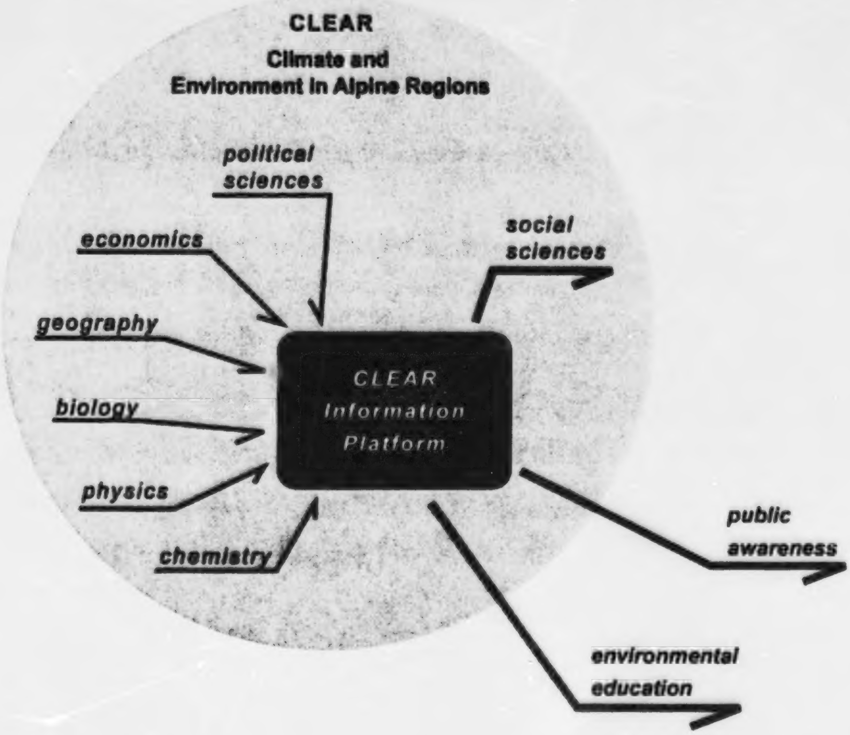


FIGURE 1: Within the CLEAR project, the Information Platform integrated the results of the various disciplinary subprojects, making them accessible for focus groups. Furthermore, it serves as an important resource for the general public and for education, thus transferring the results into the society.

Primarily, the CLEAR Information Platform served as scientific input into the focus groups for participatory integrated assessment of regional climate change. With the help of the computer tools, the citizens learned not only about the state of scientific research on climate change, but also about the uncertainties. Subsequently, the platform was extended and made available to the general public via the WorldWideWeb. It has been successfully employed in environmental education in schools and universities, offering a unique source of information on latest research results with a regional focus. Additionally, the CLEAR Information Platform is recognised as an important part of Switzerland's efforts to meet its commitment to the UN Framework Convention on Climate Change, with respect to education, training and public awareness. As an example for innovative communication of climate change research, it has been presented at last year's UN Climate Summit (COP5) in Bonn.

The CLEAR Information Platform

Apart from general information on the CLEAR project and selected publications, the information platform comprises three interactive modules. They deal with issues pertaining to individual life-style, regional impacts of climate change, and political and economic options towards a reduction of energy consumption (cf. box 1).

The *Personal CO_2- Calculator* is a straightforward tool to assess one's own energy use and carbon dioxide emission. Each input into the calculator results in an immediate response of the diagram. Thus, abstract concepts like energy consumption and carbon dioxide emission get a direct and personal meaning. (For more information on the *Personal CO_2- Calculator* and its application see Schlumpf 1999.)

IMPACTS is an interactive information system on the consequences of climate change, where the emphasis is on the regional consequences for Switzerland. It comprises some 50 chapters, ranging from impacts on biodiversity in the alpine environment and on frequency of extreme precipitation events to consequences for the construction industry and the tourism business. The information is presented in forms of texts, pictures, animations and simulation calculators (see fig. 2 and 3).

The third module, *OPTIONS*, presents the political and economical options of the Swiss society to reduce its energy consumption and CO_2 emission. The options currently discussed are displayed, additionally the user can explore various scenarios with the help of interactive simulation calculators.

BOX 1: The modules of the CLEAR Information Platform on climate change in Switzerland

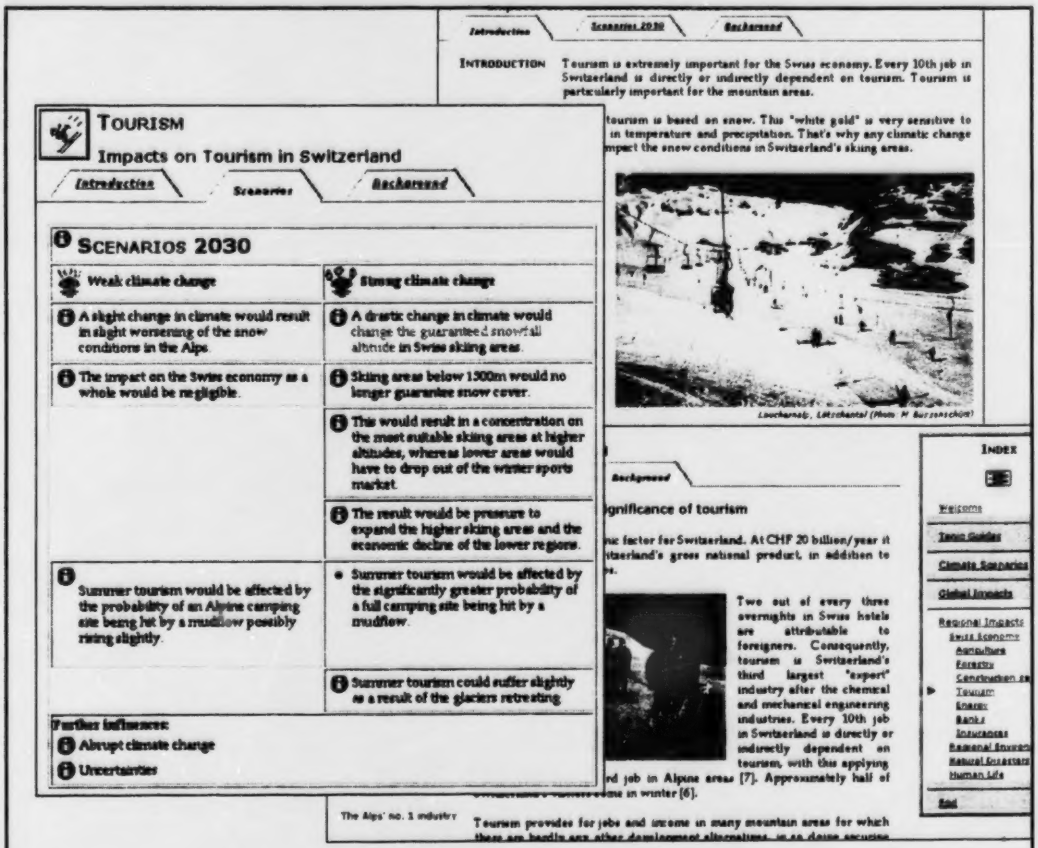
Name and URL	**Description**	**Treatment of Uncertainty**
Personal CO_2- Calculator `http://clear.eawag.ch/co2`	Calculates the individual carbon dioxide and energy balance, based on the user's individual life-style.	Uncertainty is not dealt with.
IMPACTS - Climate Change in Alpine Regions `http://clear.eawag.ch/impacts`	Displays the prospective impacts of climate change in Switzerland. Topics are e.g. frequency of natural disasters, as well as impacts on winter tourism and the construction industry.	Two scenarios for weak and for strong climate change considered throughout the module. Interactive scenario calculators display range of possibilities.
OPTIONS - Paths towards a Low-Energy Society `http://clear.eawag.ch/options`	Discusses political options to reduce CO_2 emissions and energy use on the national scale.	Interactive calculators offer the opportunity to explore different scenarios for the future, depending on users' choice of options.
SURE? - Decision Making and Acting under Uncertainty (under construction) `http://clear.eawag.ch/sure`	Explains different classes of uncertainties in scientific research and puts the user into concrete decision-making situations.	This new educational module is primarily focused on the issue of uncertainty.

The modules are accessible via the WWW with any current browser;
Java and common multimedia plug-ins required.

Forms of Expression of Uncertainty

From the very beginning, the issue of uncertainty received a great deal of attention within the CLEAR project. Therefore, this topic has been explicitly implemented into the information platform in several forms (cf. box 1). For the CLEAR researchers, it was considered very important that not only the results from the different subprojects are presented, but that also the uncertainties are made visible. In order to meet these requirements, we have chosen two different approaches in the modules *IMPACTS* and *OPTIONS*. (The *PERSONAL* CO_2*- CALCULATOR* was not intended not deal with uncertainties.)

In the first place, two different scenarios are displayed for every subject in *IMPACTS*, namely one for "weak" and one for "strong" climate change (see fig.2). They are based on different IPCC scenarios, incorporating weak and strong climate sensitivity. Hence, instead of being given one definite answer (e.g. "By 2030 approximately 75% of today's glaciers would have disappeared."), the users find themselves confronted with a second, and possibly contradicting answer (e.g. "By 2030 approximately 20% of today's glaciers would have disappeared."). Information boxes and scientific background texts explain the reasons for the two scenarios and their basis. We expected the users to discuss not only the differences between the two scenarios, but also the underlying causes for the uncertainty and how to act on the basis of uncertain predictions.



INTRODUCTION Tourism is extremely important for the Swiss economy. Every 10th job in Switzerland is directly or indirectly dependent on tourism. Tourism is particularly important for the mountain areas.

tourism is based on snow. This "white gold" is very sensitive to in temperature and precipitation. That's why any climatic change mpact the snow conditions in Switzerland's skiing areas.

Leuchernalp, Lötschental (Photo: H Bursenschön)

TOURISM

Impacts on Tourism in Switzerland

SCENARIOS 2030

Weak climate change	Strong climate change
A slight change in climate would result in slight worsening of the snow conditions in the Alps.	A drastic change in climate would change the guaranteed snowfall altitude in Swiss skiing areas.
The impact on the Swiss economy as a whole would be negligible.	Skiing areas below 1300m would no longer guarantee snow cover.
	This would result in a concentration on the most suitable skiing areas at higher altitudes, whereas lower areas would have to drop out of the winter sports market.
	The result would be pressure to expand the higher skiing areas and the economic decline of the lower regions.
Summer tourism would be affected by the probability of an Alpine camping site being hit by a mudflow possibly rising slightly.	Summer tourism would be affected by the significantly greater probability of a full camping site being hit by a mudflow.
	Summer tourism could suffer slightly as a result of the glaciers retreating

Further influences:
Abrupt climate change
Uncertainties

gnificance of tourism

ic factor for Switzerland. At CHF 20 billion/year it itzerland's gross national product, in addition to s.

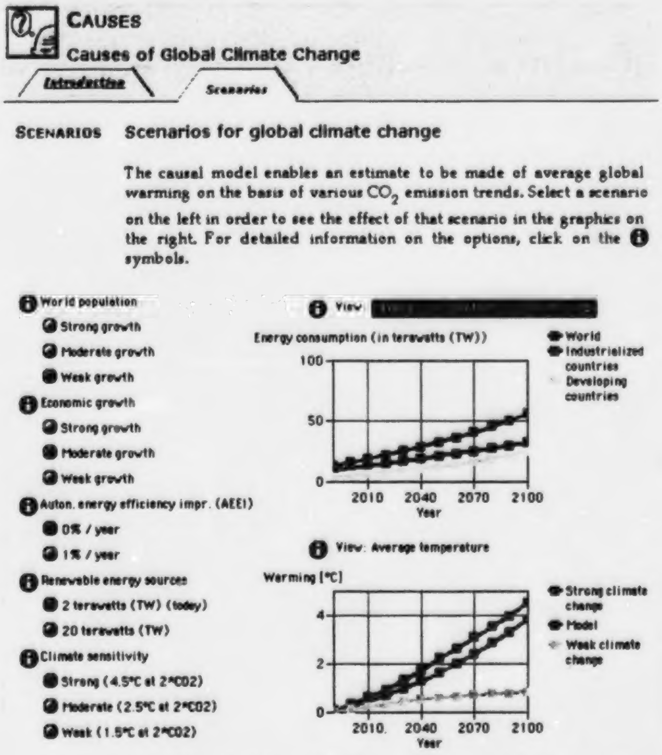
Two out of every three overnights in Swiss hotels are attributable to foreigners. Consequently, tourism is Switzerland's third largest "export" industry after the chemical and mechanical engineering industries. Every 10th job in Switzerland is directly or indirectly dependent on tourism, with this applying rd job in Alpine areas [7]. Approximately half of me in winter [6].

The Alps' no. 1 industry Tourism provides for jobs and income in many mountain areas for which

FIGURE 2: Screenshots of the three parts of a fact sheet in *IMPACTS* (e.g. effects of climate change on tourism): introduction with key questions (top), scenarios of major changes for this topic (left), scientific background (bottom). By presenting two different scenarios, the uncertainty of the predictions is made visible.

In the second place, in both *IMPACTS* and *OPTIONS*, interactive calculators allow the users to explore different scenarios for the future, based on their own input. Thereby, they get a feeling for the range of possibilities that arise from the combination of the various assumptions. In the "Causes Model" e.g. (fig. 3), the users can choose the values for five input parameters: world population and economic growth, development of energy efficiency and the use of renewable energy, and climate sensitivity. Based on the user's input, the model displays a scenario for the next 100 years, with respect to world population, economy, energy consumption, carbon dioxide emission and eventually global warming. The chosen scenario is compared to the two scenarios "weak" and "strong" climate change, as mentioned above.

By simply "playing around" with the calculator, watching the curves react to one's input, trying to reach or even surpass the set scenarios, the users observe the sensitivity and interdependence of the parameters. Even more important, it becomes apparent that their parameter choice is based on their own expectation of the future, e.g. whether they tend to be rather pessimistic or optimistic about population growth. To make things worse, common sense tells them that further research is unlikely to significantly reduce these uncertainties. Too many factors that cannot be foreseen have a major influence, e.g. on economic growth or use of renewable energy sources. Even with respect to the only parameter that does not depend on assumptions about future developments, viz. the climate's sensitivity to a CO_2 increase, a reduction of the uncertainty cannot be expected; rather,



CAUSES

Causes of Global Climate Change

SCENARIOS **Scenarios for global climate change**

The causal model enables an estimate to be made of average global warming on the basis of various CO_2 emission trends. Select a scenario on the left in order to see the effect of that scenario in the graphics on the right. For detailed information on the options, click on the symbols.

Introduction
Scenarios
World population
Strong growth
Moderate growth
Weak growth
Economic growth
Strong growth
Moderate growth
Weak growth
Auton. energy efficiency impr. (AEEI)
0% / year
1% / year
Renewable energy sources
2 terawatts (TW) (today)
20 terawatts (TW)
Climate sensitivity
Strong (4.5°C at 2*CO2)
Moderate (2.5°C at 2*CO2)
Weak (1.5°C at 2*CO2)
View
Energy consumption (in terawatts (TW))
100
50
0
2010
2040
2070
2100
Year
World
Industrialized countries
Developing countries
View: Average temperature
Warming [°C]
4
2
0
2010
2040
2070
2100
Year
Strong climate change
Model
Weak climate change

FIGURE 3: The scenario calculator for the causes of climate change. By varying the five input parameters on the left, the users can explore different scenarios of global warming. It is important to notice that the uncertainty in the input parameters will only be partly reduced by further research.

new research tends to reveal even more sources of uncertainty.

EXPERIENCES WITH THE CLEAR INFORMATION PLATFORM

Educational Settings

The CLEAR Information Platform has been employed in several instances with students at schools and universities. They used *IMPACTS* as a resource e.g. to create a regional scenario for their hometown, or to prepare for a panel discussion on the necessary political and economical steps to adapt to climate change on the regional level. These educational settings were evaluated in discussion with all participants and with the help of questionnaires for the students.

The overall image from the evaluation of *IMPACTS* has been very positive. Teachers judged their students as being extremely well informed in the discussion, students found the information to be very well structured and complete. They felt enabled to work independently on a subject related to climate change, and, eventually, they had fun working with *IMPACTS*. These statements coincide with observations during the course.

With respect to uncertainties, however, the image has been more controversial. According to the students' answers, uncertainties are well represented in *IMPACTS*. Nevertheless, the issue was hardly ever discussed in depth, neither in the small working groups nor in class. The students rather viewed the two scenarios as best/worst case analyses and picked one according to their preferences, without deeper consideration. Talking to the teachers it became clear that irreducible uncertainties in scientific findings had not been a subject in any science course before, hence, the students' inadequate handling of this aspect was by no means surprising. Yet, we agreed that it would be increasingly important to deal with this issue in school, e.g. with the help of resources like *IMPACTS*.

Focus Groups

The primary target audience for the CLEAR Information Platform were citizens in focus group settings. (See the paper by Stoll in these proceedings for a detailed description of the focus group approach and further results.) In one or more sessions, the citizens worked with *IMPACTS* and *OPTIONS* in order to access information about the current state of climate change research with a special focus on Switzerland. The focus group outputs, collages, citizen reports and questionnaires, as well as the transcripts of the group sessions themselves, were then analysed by social scientists within the CLEAR project.

More than in the educational settings mentioned above, the focus group members were explicitly directed towards discussing the uncertainties in the scientific statements. Therefore, a more precise image can be obtained from the analysis of the discussions. The citizens' attitudes can be characterised by two opposing perceptions of science (Schibli 2000): A more classical view that asks for clear statements, and a more reflective view that not only accepts but even demands different opinions:

In the classical-modern view, science is expected to "speak with one voice" and to give clear directions how to deal with a specific situation like climate change. Consequently, the citizens' primary reactions towards the presentation of uncertainty in *IMPACTS* and *OPTIONS* were negative: they felt helpless being confronted with opposing scientific statements, they questioned the scientific rigour or rejected the results as a whole. Furthermore, they deplored that the lack of a uniform appearance of science with respect to climate change was a major obstacle for political action.

At various instances, however, a new, reflective view upon science could be noticed. In this view, scientists are accepted as people with social backgrounds, with stakes and opinions. Consequently, they may come to different conclusions. Some citizens specifically demanded to see the uncertainties, to be informed about underlying assumptions of the models, to be told about the limits to knowledge: this would eventually add to the credibility of science. Yet, the careful analysis of the focus group discussions revealed that this new view still stands on shaky grounds: some sentences later, the same citizen might again demand a precise answer from the scientists, rejecting the possibility of irreducible uncertainty.

A NEW MODULE ON UNCERTAINTY

These experiences from focus groups as well as from educational settings showed that the topic of uncertainty is essential but that yet more effort is needed to communicate the subject satisfactorily. We are therefore developing a new module *SURE?* which focuses on decision making and acting under uncertainty. The module is targeted mainly at the educational sector (universities and schools); much emphasis is given to didactic aspects.

The module consists of two parts, the archive and the role-play section. The archive contains information on the different kinds of uncertainties that arise in scientific research, explains whether they can be avoided or reduced, and discusses the consequences for societal action. While the subject is universal, it is treated with respect to climate change, thus connecting *SURE?* with the other modules of the CLEAR Information Platform.

In the role-plays, groups of students are confronted with concrete decision situations. Thus, they are challenged to reflect upon their own handling of different types of uncertainties. They are supported by students acting as independent observers, who provide feedback after each play. The role-play situations range from simple everyday decisions (like whether to take an umbrella) to complex cases in fields with high and controversial stakes (like political decisions with respect to CO_2 reduction). It is planned to create an open library of role-play set-ups on the WorldWideWeb, such that students and other users can submit their own situations.

A first version of *SURE?* will be employed in a course at ETH Zürich this winter. In a mixture of traditional lectures and computer assisted learning, the students will work on the issue of decision making and acting under uncertainty. This theoretical part will be complemented by experiential learning in a number of role-plays.

CONCLUSIONS

While the aspect of uncertainty plays an extremely important role in the current discussion around political action with respect to climate change, the communication of uncertainty in scientific results is still in its infancy. In the general public, the predominant perception of science calls for unanimous statements and precise directions; where uncertainties are made apparent the scientific rigour of the research is questioned.

Communication tools like the CLEAR Information Platform in Switzerland present a unique way to present current results of climate change research without neglecting the uncertainties involved. Working with these resources, users are confronted with different and opposing findings, with scenarios that cover a wide range of possibilities, with the necessity to decide upon basic assumptions themselves. Thus they offer valuable help for educators who want to deal with the issue of uncertainty in class. While it would be naïve to expect that a few hours spent with an information tool like this could immediately change the user's perception of science, the educational sector offers good starting points to initiate the necessary shift towards a new, reflective view upon science. ❑

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A Coevolutionary Approach to Climate Change Impact Assessment in the UK

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To date, attempts to couple climate futures with economic futures have generally treated the climate system as being independent of human behaviour. In reality, however, the two are tightly coupled. The authors address this discrepancy by proposing a 'coevolutionary' approach, integrating scenarios of climate and socio-economic changes. Stakeholder interviews in the East Anglia region of the UK indicate that this novel approach promotes the consideration of potential feedbacks between natural and human systems, and encourages individuals and organisations to 'learn' about the future by assessing their existing strategies.

INTRODUCTION

Changes in the world's climate have always occurred in the past; yet observational data over the last two centuries show that recent temperature increases cannot be explained by natural phenomena alone (e.g. Wigley, 1999). Evidence suggests that variations in the climate at present and to a certain extent in the future should be ascribed to human activities in addition to natural variability (IPCC, 1997).

To date, anthropogenically-induced climate change has been addressed through policies which have largely focused on reducing the long-term influence of human actions on the climate, by curbing greenhouse gas emissions (IPCC, 1996; Grubb et al., 1999). However, greater attention is currently being directed to the adaptation of societies to the impacts from climate change in the near future (Smithers and Smit, 1997; Rayner and Malone, 1998; Parry et al., 1998), given that changes in the climate within the next 25 years will occur due to greenhouse gases released into the atmosphere as a consequence of current and recent socio-economic activities, independently of any policies and measures implemented in the meantime. However, the actual degree of climate change in the medium to long term (i.e. by the 2050s) is not determined, but will depend to a larger extent on mitigation and adaptation decisions.

Mitigation policies have been mirrored on the ground by campaigns aimed at sensitising businesses, organisations and individuals to the issue of climate change, in the belief that the measures advocated to reduce greenhouse gas emissions will be effective and will lead to behavioural and structural changes. However, if social actors do not believe that their actions contribute to climate change or do not feel it is possible to significantly limit their effect, any attempts to curb emissions are likely to fail. In assessing support for measures and policies aimed at reducing anthropogenic contributions to climate change, the literature has frequently cited the very uncertain nature of climate change and the difficulty of observing these changes in everyday life as factors that affect their acceptance and successful implementation. Other variables, such as knowledge of the issue in question, perceived risk, beliefs and trust in government also affect individuals' views on environmental measures (e.g. O'Connor et al., 1999, Langford et al., 1999). It is not, therefore, a question of only providing scientifically sound information, but also of tailoring this information to address the different perceptions on the issue, with a view to further engaging individuals in thought processes and dialogues about the options available and the possible outcomes (e.g. Weber and Corrado, 1993; Kempton, 1997). Several studies undertaken throughout Europe have highlighted the importance of these components by involving stakeholders in discussions on environmental issues and climate change - for instance the ULYSSES project and the current Dutch COOL program (e.g. Boardman et al., 1996; Smith and Kemp, 1998; Berk et al., 1999).

Clearly, in promoting mitigation measures to reduce the human influence on the climate, the close relationship between natural and social systems is acknowledged. To date, however, climate change impacts studies generally have relied upon extrapolating current or recent socio-economic trends into the future, separately from climate change. In this paper it is argued that by understanding the inter-dependency of society and the environment, and by viewing these as two coevolving systems, individuals and decision makers will be able to assess the adaptation and mitigation options available in the future and to chose which 'path' to follow.

We describe a novel approach based on integrated socio-economic and climate scenarios in the context of a particular region in the UK, addressing the necessity of combining adequate tools to communicate the inter-dependency and 'coevolution' between natural and human systems. The paper initially introduces the concept of coevolution, the characteristics of the East Anglia region and the use of scenarios. The following sections outline the procedures leading to the integration of climate and non-climate scenarios for the study area and the outcomes deriving from their presentation to locally important stakeholders.

SETTING THE SCENE: "COEVOLUTION" AND THE REGION OF EAST ANGLIA

Coevolution, as originally promulgated by Norgaard (1984, 1994), describes the constant, dynamic and active interaction between a living organism and its environment. Thus, Norgaard argues, as societies evolve, the environmental resources at their disposal are used increasingly more efficiently. As a consequence of pressure from social systems, the environment undergoes modification, which in turn sparks change in societies. Interactions between natural systems and humankind therefore cannot be disentangled: the two systems are coupled (Norgaard, 1984; Adger, 1998). Taking this notion further, a coevolutionary approach suggests that there will be no climate or environmental futures devoid from human activities. This rationale is pursued in this paper: future climate scenarios are combined with a series of pictures about the social, economic and environmental elements affecting specific economic sectors in East Anglia to uncover feedbacks between the two.

East Anglia is a fast-growing region in the eastern United Kingdom, bordered on two sides by eroding coastlines. It includes large areas of fertile agriculture land, some of which are below sea level, and other more heavily developed areas, such as the cities of Norwich and Cambridge and ports on the eastern coast. While East Anglia is not representative of the varied social and economic conditions found across the world, a detailed study of this particular region highlights a number of key aspects of societal vulnerability and adaptation to climate change. These are likely to be determined in large part by local, place-specific factors (Adger, 1999; Kelly and Adger, 1999), since the underlying characteristics of the actors or areas "exposed to climate variations" (Parry and Carter, 1998:9) vary across space and time.

ORIGINS AND APPLICATIONS OF SCENARIOS

A scenario is a coherent, internally consistent and plausible description of a possible future state of the world (Parry and Carter, 1998). Scenarios suggest how the world *could* look like under different conditions (Elkington and Trisoglio, 1996). The value of scenarios was recognised by oil companies such as the Shell Group in the 1970's when they were developed as a strategic management aid to better deal with future events and unexpected circumstances (Kassler, 1995; Hammond, 1998).

Futures scenarios-based studies are increasingly being applied as a means of obtaining a better understanding of the potential for societal adaptation to future environmental change (Gallopin and Raskin, 1998). For instance, in Europe, scenarios approaches have been applied to wide areas of research such as electricity, energy (Patterson, 1999), epidemiology (McMichael, 1999), and to gauge possible social, economic and political conditions in the decades up to 2080 (Parry, 2000). The IPCC has used scenarios to understand future emission profiles, although more recently, climate and socio-economic scenarios have been employed to investigate climate change impacts, vulnerabilities and adaptive responses. The forthcoming IPCC report is likely to underline the need for a more integrated approach to their development and application.

The study presented in this paper responds to the call for more 'integrated' approaches in two respects: firstly, emissions scenarios are linked to scenarios of future socio-economic change for a particular region where the impacts of climate change will eventually be experienced. Secondly, the climate scenarios used in this study derive from large-scale climate models and expert judgement, but their application and interpretation takes place at a more local level with stakeholders, combining their 'bottom-up' knowledge with the tools of integrated assessment developed 'top down' (Parson, 1995).

THE EAST ANGLIA FUTURES SCENARIOS

The process leading to the combination of socio-economic and climate scenarios for the East Anglia region of the UK was undertaken in three separate stages (described in following sections):

1. Re-calibration of national OST socio-economic scenarios for the East Anglia region;
2. Integration of climate and 'non-climate' regional scenarios on compatible timescales;
3. Presentation of the East Anglia futures scenarios to locally important stakeholders, through individual interviews and group discussions.

1 Re-calibrating socio-economic scenarios for East Anglia

Following an extensive review of the literature on the published scenarios adopted by various organisations and institutions in futures studies, we chose the scenarios formulated for the Natural Resources and Environment Panel of the UK Foresight Programme (OST, 1999) as the starting point for our work. These scenarios, herewith *OST Scenarios*, were originally coined to address future social, economic, environmental trends for the UK in the forthcoming decades (2010-2040). They are depicted as four quadrants representing four possible future 'worlds' which are framed by two orthogonal axes, delineating societal values (ranging from consumerist to conservationist) and levels of governance (from local to global). The *OST Scenarios* are malleable so that they can be used by different sectors; they are also comparable to other scenarios, for instance, the global scenarios developed by the World Business Council for Sustainable Development (WBCSD, 1997).

The *OST Scenarios* were re-calibrated to include a set of simple themes adapted to the East Anglian context to make them intelligible for people who may have had little experience of using scenarios. Two different timeframes, the years 2025 (2020s) and 2055+ (2050s and beyond) were selected on the grounds that they were broadly comparable with those used employed in the OST Futures Scenarios study and the preliminary IPCC SRES98 emissions scenarios, and that they provided a basis on which to assess social and environmental changes on commensurate timescales. The characteristic four-quadrant structure of the *OST Scenarios* was also adopted in the East Anglian scenarios to portray a value-neutral representation of the four worldviews and to overcome the potential problem of maintaining consistency among respondents.

2 Integrating climate and 'non-climate' scenarios

The second step was to couple the *OST Scenarios* with consistent climate change scenarios.

The *OST Scenario* storylines were compared with the four storylines in the preliminary SRES98 scenarios. They were found to share a similar underlying structure and comparative logic, although the SRES98 marker emissions scenarios describe different "non-intervention" worlds, that is, possible global futures not taking account of the effects of climate change or explicit climate change policies. On the other hand, the *OST Scenarios* have a wider scope encompassing 'non climate' sectors and environmental changes.

Given these similarities, the *World Markets* (WM) world of the *OST Scenarios* was taken to correspond to the A1 SRES storyline, *Local Stewardship* (LS) to B2, *Provincial Enterprise* (PE) to A2 and *Global Sustainability* (GS) to B1. The comparability between the *OST Scenarios* and the preliminary SRES98 scenarios was established after additional considerations, including determining correspondences of global greenhouse gas emissions related to each world. This led to matching each of the worlds in the *OST Scenarios* to one of the SRES scenarios in terms of storylines and emission figures.

Subsequently, the four worlds of the *OST Scenarios* were compared to the four UKCIP98 climate scenarios modelled for the UK (Hulme and Jenkins, 1998). By relating emissions from the *OST Scenarios* with the global warming rates of the UKCIP98 scenarios, it was possible to associate different warming rates (and therefore different UK climates) to the different socio-economic *OST Scenarios*. The WM/A1 scenario was related to a Medium-high warming rate; GS/B1 to a Low warming rate; PE/A2 to a High warming rate and LS/B2 to a Medium-low warming rate. Each of these four UKCIP98 climate scenarios was then re-interpreted to obtain possible future climates for East Anglia in the 2020s and the 2050s, resulting in each of the four *OST Scenarios* re-calibrated to East Anglia being linked to one of the UKCIP98 climate scenarios.

3 The East Anglia case study

The prototype scenarios thus assembled for East Anglia were depicted simply by: (1) four worlds, characterised in terms of growing and declining economic sectors, climate policy and strategy; (2) climate changes for each of the four 'worlds' with respect to today; (3) a summary of the key characteristics (socio-economic and climate) of each 'world'. For the 2050s, an additional information sheet was devised illustrating the possible effects of particular socio-economic systems in conjunction with climate change on illustrative sectors of the East Anglian economy. These were derived *via* an assessment of the sectoral consequences of the socio-economic and climate characteristics in each world. These were not intended to be prescriptive, but rather a means of prompting responses from the interviewees regarding their scope for climate change vulnerability and possible adaptation.

These resulting prototype scenarios were tested with locally important stakeholders in four pilot face-to-face interviews. The respondents were initially asked to describe what information, if any, they required about current and future rates of social and economic change. They were then presented with the prototype sheets for the 2020s and asked to reflect upon the implications of the trends for the management of their own organisation. Interviewees were also asked whether they thought the scenarios were clear and meaningful, and whether some modification was needed. The same process was repeated for the 2050s, stressing the challenges presented by climate change across the four quadrants.

Feedback from the respondents during these initial interviews revealed some disagreement about the terminology and figures used in the scenarios. Many respondents felt that the scenarios could be made simpler with greater contrast between the quadrants, and that possible internal perturbations, which could alter the underlying rationale of some of the quadrants, had been omitted. We tried to balance these considerations with the amount of information given in order to produce consistent and replicable findings.

Once the suite of scenarios had been modified to include the feedback received during testing, an additional 18 stakeholders in the East Anglian region were approached and asked to reflect, following the same format detailed above, upon their vulnerability and ability to adapt to the future. Particular attention was paid in the selection process to those sectors which the existing UK literature on climate impacts identifies as being especially sensitive to climate change (e.g. CCIRG, 1996, Palutikof *et al.*, 1997). The affiliations of the 22 interviewees are shown in Table 1 (their actual identity is kept confidential at their request). The East Anglia scenarios were also presented at two stakeholder workshops: one group comprised local environmental regulators and environmental managers; the other included local environmental managers, regulators and business representatives.

FINDINGS OF THE EAST ANGLIA STUDY

"Engagers" and "non-engagers" The stakeholders interviewed responded to the East Anglia scenarios in two different ways. 'Engagers' appeared to learn new things about climate impacts, and some began to consider the implications of future changes on themselves and their activities. Engagers used the scenarios to develop their own ideas and elaborate on the information supplied, introducing local texture into the discussions on future possibilities for the region. A minority of the respondents, however, remained focused on the descriptions supplied by the prompt sheets; these 'non-engagers' were disconcerted by the complexity of the possible feedbacks between mitigation and adaptation, natural and human systems.

TABLE 1. The Institutional Affiliation Of The East Anglian Interviewees.

Representation of sectors by the interviewees	*No. of interviews*
Agriculture, land and countryside	3
Contractors to the offshore sector	1
Energy (electricity)	1
Environmental organisations	4
Governmental institutions	2
Health service	2
Insurance	1
Local authorities (city and county level)	3
Tourism	1
Transport (within local authorities, rail and port)	2
Waste management (small and medium size enterprise)	1
Water	1

Groups and individuals Our scenarios were used both in group and individual contexts. Face-to-face interviews allowed more time to consider detail, resulting in a more focused discussion based on a deeper knowledge of the contents of the scenarios themselves. On the other hand, group discussions tended to enhance communication and learning among respondents about impacts in related sectors.

Scenarios as a didactic tool The scenarios were designed to enable stakeholders to interpret, use and enrich them in their own way. Indeed the vast majority saw the open-ended and non-deterministic presentation of the worldviews as the one of the main advantages of our approach, as it encouraged them to question their existing interpretations of the world (altering them to possibilities or threats which they had not considered before) and the choices that need to be made with respect to climate impacts.

Time horizons This research brought to the fore the very short timescales used by local stakeholders in comparison to the longer time horizons over which scientists predict rates of climate change. Although most respondents were able to consider future events up to the 2020s, they identified many short-term constraints upon their ability to prepare accordingly: current incentives and constraints imposed by central government appear very uncoordinated and represent huge problems in developing national adaptation strategies. The majority of the interviewees considered the 2050s and beyond too far into the future to deserve dutiful consideration.

The value of integrated scenarios Linking socio-economic and climate trends was appreciated by the stakeholders as it clearly illustrated that, whereas society is already committed to the climate outcomes for 2025 (irrespective of whatever actions are taken in the immediate future), long-term future paths will depend on taking corrective measures now. Scenarios can therefore be used to communicate these concepts to a wide audience. For this to occur, scenarios have to be sufficiently intelligible to the stakeholders approached.

CONCLUSIONS

With this paper we have sought to test the utility of integrated scenarios in a region of the UK, to build and enrich what is already known about adaptation and vulnerability. We suggest that integrated scenarios applied from the 'bottom up' have the potential to uncover new information about how society might adapt itself to future climate change. Local stakeholders certainly find them a valuable means of identifying long-term threats to their welfare. And if decision-makers have a clearer idea of how local stakeholders will behave under certain conditions, they can begin to develop more informed and more coherent national adaptation strategies.

Although there are a number of methodological issues that still need to be resolved about the use of scenarios in different contexts, on the basis of this article we conclude that this approach produces a more sophisticated and dynamic account of the potential feedbacks between natural and human systems than simple top-down assessments. The scenario framework illustrates how mitigation and adaptation can be presented and perceived as connected. In particular, our scenarios provide a useful tool that works across different disciplines, different spatial scales, and different sectors of society.

In addition, by combining socio-economic and climate scenarios we have tried to present a more dynamic image of the future to the very people who will need to chose key make adaptive responses over the next three decades. To these choices are attached possible outcomes: scenarios are a means of making them open and transparent (c.f. Schneider, 1997).

The scenarios we developed also encourage social learning. There is evidence that increased awareness does not necessarily indicate greater understanding (e.g. Cohen, 1997). So in this study, we involved stakeholders in discussing outcomes and future options by using the scenarios to assess the adequacy of their existing climate strategies for longer than their normal planning periods (currently, most organisations in East Anglia do not plan for longer than 20 years and many do not look much beyond three years into the future). This suggests that 'engagers' who have the means to link their management and investment practices to strategic adaptation approaches may do more. Appropriate patterns of incentives and regulations need to be put in place to help this cause.

Ramifications of the approach presented in this paper are varied. Our scenarios work could be extended and refined by enriching the scenarios with other simple and meaningful representations the scientific understanding of climate change. These would be defined and stipulated in consultation and through discussion with stakeholders whose decisions and actions will be influenced by, and will in turn influence, changes in the climate. Hopefully, these would serve stakeholders in a more pragmatic manner to define their future strategies and options, perhaps further paving the way to address confusion over the issues concerning climate change and the options for change, which many individuals have voiced as 'what should I do?' in contrast to 'what can I do?' ☐

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Using Integrated Assessment Models in Conversations with the Public: ULYSSES in Vancouver (Canada)

Pamela Robinson

ABSTRACT

The European project ULYSSES (Urban LifestYles, SuStainability and Integrated Environmental Assessment) aimed to bridge the gap between environmental science and policy making in the climate change domain. Through the use of integrated assessment models in a focus group situation, this study was designed to address the lack of public participation and understanding in climate change research. The Canadian version of this project was jointly conducted by the AIR Group and the Sustainable Development Research Institute.

Vancouver ULYSSES used citizen focus groups to discuss the relationships between participants' personal lifestyles and their cumulative environmental consequences - particularly as they related to climate change. This research was based on the following objectives:

1. *To examine public perception and understanding of the relationship between urban lifestyle and climate change.*
2. *To examine whether or not the use of integrated assessment modeling tools increases the understanding of the relationship between urban lifestyles and climate change.*
3. *To examine how facilitated discussions of climate change issues and urban lifestyle alter this perception and understanding.*
4. *To examine how the use of integrated assessment modeling tools affects the public's trust in scientists and personal comfort with the science of climate change.*

The focus group sessions provided important information about the potential avenues and obstacles to democratic consensus about response to climate change. They also provided an opportunity to test and improve the use of integrated assessment models in fostering public debate and understanding of the public policy trade-offs involved with complex issues such as climate change and sustainable development.

In this paper, I explore the findings from the Vancouver ULYSSES project to evaluate the success of the project in meeting the research objectives and use these findings as the foundation for series of recommendations for future research and policy-action with regard climate change response. Particular emphasis is placed on exploring the contribution of this research to better informing the design and use of integrated assessment models as a tool for engaging the public in discussions about the action needed to deliver sustainable solutions to environmental problems.❑

Session E3

LINKING CLIMATE CHANGE KNOWLEDGE AND ACTION

Global Environmental Change: Modifying Human Contributions Through Education
Lynne M. Carter
National Assessment Coordination Office

Climate Change Knowledge and Attitudes: Links to Action in the Residential Sector
Ian H. Rowlands,[1] Daniel Scott,[2] and Paul Parker[1]
1. University of Waterloo
2. Environment Canada

Developing a Measure of Public Understanding of Climate Change and Willingness to Act When Science is Uncertain
Rosanne Fortner, Jeffrey Corney, Jae-Young Lee, and Samantha Romanello
Ohio State University

Embracing Uncertainty in Climate Change Decision-Making
Tamara Levine
University of Waterloo

Global Environmental Change: Modifying Human Contributions Through Education[1]

Lynne M. Carter

The 1995 IPCC Science report concludes that evidence now available "points toward a discernible human influence on global climate". Reductions in emissions will require changes in human behavior. Knowledge, often through education, is an important moderator of human environmental behavior. This study assessed whether gains in global environmental change knowledge would lead to changes in human behaviors that could be deemed environmentally responsible.

The study assessed a two-and-a half day National Informal Educators Workshop and Videoconference held November 14-16, 1994. The workshops were located in seven down-link sites around the continental US and Hawaii. The program utilized a variety of pedagogical techniques during five hours of satellite programming of national expertise on global change topics (natural variability, greenhouse effect, ozone depletion, ecosystem response, and population and resource distribution) and applications of that information with local experts on regional issues.

Participants implemented many personal and professional behavior changes after participation in this program. Six behavior change scales were created from assessment of survey responses (four coefficient alphas were above .7, one was .68, and one was .58). Personal behavior changes grouped into three categories: Use of Fewer Resources (acts of everyday life generally under volitional control), Purchasing Choices/Options (less frequent acts, not under total volitional control, with significant environmental effect over the lifetime of the decision, e.g., an automobile) and Increased Awareness and Discussion (indicating changes in "habits of mind"). The professional behavior changes also grouped into three categories: Curriculum Development (developing/revising curricula including new knowledge); Networking (with colleagues from the program); and Office Procedures (reflecting environmentally responsible behavior). The statistically significant behavior changes implemented (reported eight months after the program) correspond with increases in content knowledge, confidence, a developing national network, regional applications, and satisfaction with the program.

BACKGROUND

Various scientific studies, particularly the 1995 Science report of the Intergovernmental Panel on Climate Change (IPCC), conclude that evidence now available "points toward a discernible human influence on global climate" (p. 439). The anthropogenic activities contributing to emissions that are important to climate changes are undertaken by all members of the human population. Reductions in those emissions will require changes in human behavior. Knowledge, often through education, is an important moderator of human environmental behavior. This study assessed whether gains in global environmental change knowledge would lead to changes in human behaviors that could be deemed environmentally responsible.

Human behavior is complex in that it can be influenced by both psychological or internal factors as well as social or external factors. According to Simon (1992) and others (e.g. Bandura 1991), an individual's goals are important directives for behavior along with their values, attitudes, circumstances, knowledge, skills, experiences, and social contexts. Knowledge, generally gained through education, is an important moderator for environmental behavior and choice (Arcury, 1990; Hungerford and Volk, 1990; Stern, 1976) and can influence individuals' behavior and choices through both internal and external functions. Environmental knowledge is very low in the United States (Maloney and Ward, 1973; Miller, 1991; Arcury, 1990) and particularly lacking and confused related to global environmental issues (Kempton, 1991; Read et al., 1994; Bostrom et al., 1994). This is especially so in terms of understanding the anthropogenic activities that enhance natural cycles and the environmental consequences of those activities for both humans and the natural world over both the short and long term.

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[1] A version of this paper appears in the New England Regional Climate Change Impacts Workshop(Sept 3-5, 1997) Summary report.

While there seems to be a great deal of expressed concern about environmental degradation, nationally and globally (Krause, 1993; Kempton et al., 1995; Dunlap et al., 1992), most individuals see the responsibility for changing environmentally destructive behaviors belonging to technological development and industrial practices rather than to changing their personal behaviors (Dunlap et al., 1992).

The traditional success noted in behavioral research occurs when participants change their behavior during some type of intervention period. Unfortunately, that immediate behavior change is often externally derived and not durable (DeYoung, 1993). Long term change seems to be related to less quantifiable, internally derived attributes identified by many researchers as personal insight, intrinsic satisfaction, care and concern, compassion, commitment, an internal locus of control, confidence, a sense of environmental ethics, morals, personal responsibility, environmental sensitivity, or a more spiritual or traditional approach to nature (e.g. DeYoung, 1993; Geller, 1995; Milbrath, 1989; Bowers, 1995, Hines et al., 1986-87, Hungerford and Volk, 1990; Bandura, 1991). These internally derived attributes can be supported through gaining more tangible and concrete information and knowledge about an issue of importance, such as, in this case, global environmental change.

THE STUDY

The study assessed a two-and-one-half day National Informal Educators Workshop and Videoconference held November 14-16, 1994. The workshops were located in seven down-link sites around the continental U.S. and Hawaii. The program utilized a variety of pedagogical techniques during five hours of satellite programming of national expertise on global change topics (natural variability, greenhouse effect, ozone depletion, ecosystem response, and population and resource distribution) and applications of that information with local experts on related regional issues.

Pilot Survey

A pilot survey was developed and administered to each of the 315 participants nationwide prior to the beginning of the conference, at the conclusion of each satellite session, and at the conclusion of the conference. The pilot utilized open-ended questions to encourage the participants to reflect on their: learning expectations; learning results; the scientific content; applications of this information to real-life choices and behavior (behavior alert); and the use of the technology in the learning process. Three sections of the pilot surveys (learning expectations, learning results, process) were analyzed to provide direction for the final questionnaire.

Sample

Informal and formal educators from around the U.S. and Canada, including the U.S.–affiliated Pacific island entities were participants in this educational video conference. They were the focus for many reasons, two of which are: environmental educators are believed to embody the crucial (considered prerequisite to responsible environmental behavior) entry level variables identified by Hungerford and Volk (1990) of environmental sensitivity, knowledge of ecology, psychological androgyny, and attitudes toward pollution, technology, and economics; and most have the ability to reach many members of the public through their work. Of the 315 participants nationwide, 79 responded to the follow-up/final questionnaire and became the study sample. Demographic characteristics of the sample include: age (29-72 years); income (less than $20,000 to over $60,000 per year [U.S. dollars]); gender (twice as many women as men); education (from high school graduates to

Ph.D.); region (Northeast, Mid Atlantic, Gulf Coast, Mid Continent, Pacific, Great Lakes, Hawaii and the Islands); affiliation (government, non-profit agencies, and educational institutions); and educational background (mostly science–75% and education–39% = more than 100% because participants could have both types of backgrounds).

Final Survey

The results of the final questionnaire, administered eight months after the program, are reported in four sections. In the first section the participants' responses to the survey questionnaire are reported using descriptive statistics such as percentages, means, and standard deviations. In the second section three personal and three professional behavior change scales are created. Scale construction was undertaken to simplify the data resulting in new factors that represent groupings of interrelated variables used to describe the personal and professional behavior changes implemented. Scale creation was accomplished by logically grouping items and then testing the scales for internal consistency reliability. The statistic to test internal consistency was Cronbach's Alpha (Nunnally, 1978). High alphas are generally 0.7 or above. Four of the six behavior change scale alphas were above 0.7; one was very close at 0.68, and only one scale had a low alpha of 0.58.

On the personal behavior change list activities are in three groupings, the first is the Use of Fewer Resources which included both using less (e.g. drive less) and using an alternative more (e.g. recycle more). Both forms of activities represent a change in normal social behavior that results in using fewer resources and is often under personal, volitional control. Looking ahead to more long-term decisions resulted in the second category: Purchasing Choices/Options and incorporated looking for or choosing autos and appliances that either utilized an alternative energy source (e.g. natural gas over coal or oil) or utilized less energy (e.g. more efficient appliances). The final personal category had to do with broadening one's awareness and influence related to applying global environmental change issues and became Increased Awareness and Discussion.

The professional behavior change scales incorporated items that also fell into three categories. The first is Curriculum Development and includes items that relate to changes in planned or offered programs including revisions to programs either as an individual or as a member of a team and utilizing teaching techniques and materials gained from participation in the video conference. The second category of Networking could include networking either regionally or nationally. The third professional behavior change scale was made up of items representing changes in Office Procedures that included energy efficiency concerns in equipment purchasing review.

Summary of Results

Section One: Direct Questionnaire Responses

- Many respondents reported making personal (65% recycle more) and professional (56% utilized some or all of the resource materials provided) behavior changes.
- Respondents indicated meaningful increases in substantive and specific knowledge in all five content areas (60% and greater).
- 95% of respondents reported feeling more confident in talking about global change issues while another 90% reported feeling more confident in approaching additional content material.
- More than three quarters (78%) of respondents expressed a new sense of urgency in passing on global change knowledge.
- The scientific content was extremely or quite important to 91% of respondents and 82% were extremely or quite interested in receiving teaching techniques and resources to assist in passing-on this information to others.
- Information in all five content areas (natural variability, greenhouse gases, ozone depletion, ecosystem response, and population and resource distribution) was extremely or quite important to more than 50% of individuals' environmental actions.
- National and regional components of the program, as well as content instruction and teaching techniques,

were extremely or quite important to more than 80% of the respondents in ranking overall success of the program.

- Participants showed a high degree of satisfaction with participation in the program (8.2 on a 10 point scale).
- Participants rated Global Environmental Change issues as extremely important (9.5 on a 10 point scale).

Section Two: Behavior Change Scales

Personal Behavior Change Scale	Item	Internal Consistency Reliability Coefficient Alpha
Use of Fewer Resources		.74
	1. Drive less	
	2. Walk or ride bike more	
	3. Use less water	
	4. Use less electricity	
	5. Recycle more	
	6. Use fewer disposables	
Purchasing Choices/Options		.77
	1. Look for/choose natural gas over coal or oil	
	2. Look for/purchase auto with higher mpg	
	3. Look for/purchase more efficient appliances	
	4. Look for/purchase appliance and auto w/no CFCs	
Increased Awareness and Discussion		.58
	1. Discuss environmental issues with family and friends more often	
	2. Notice waste	
N=79		

Professional Behavior Change Scale	Item	Internal Consistency Reliability Coefficient Alpha
Curriculum Development		.78
	1. Developed/offered new programs/curricula	
	2. Revised programs/curricula to include new information	
	3. Developed/offered new programs/curricula along disciplinary lines	
	4. Developed/offered new programs/curricula interdisciplinarily	
	5. Worked with a team on new programs	
	6. Developed/offered new programs alone	
	7. Utilized some or all teaching techniques	
	8. Utilized some or all resource materials	
	9. Have planned/offered a video conference	
Networking		.74
	1. Utilized network developed through video conference	
	2. Have collaborated with colleagues from video conference	
Office Procedures		.68
	1. Instituted changes in office procedure	
	2. Included energy efficiency in equipment purchase review	
N=79		

Sections Three and Four: Significant Relationships between Demographic Characteristics and Descriptive Reports and the Personal and Professional Behavior Change Scales

Personal

- Those from the Pacific and the Northeast Regions made greater changes in using Fewer Resources than those from other regions.
- Those with an Education background indicated a statistically significant relationship with Increased Awareness and Discussion of Global Environmental Issues.
- Those who gained confidence in talking about Global Change issues also made statistically significant gains in Increased Awareness and Discussion of Global Change Issues.
- Those who increased their confidence in approaching additional content material made statistically significant gains in all three of the personal behavior change scales.
- Those who expressed a new sense of urgency in passing-on this information made statistically significant gains in all three of the personal behavior change scales.
- Of the five topics, greenhouse gases, ozone depletion, and ecosystem response were the most important in participants' gains in the personal behavior change scale of Increased Awareness and Discussion.
- Learning the science content related to greenhouse gases and ozone depletion supported the Use of Fewer Resources.
- Gains in the personal behavior change scales were most closely related to a number of national program components and to one regional component, the workshops (overall).

Professional

- Those who gained confidence in talking about global change issues and in approaching additional content material made statistically significant changes in Curriculum Development.
- Of the five topics, natural variability, greenhouse gases, and population and resource distribution were most important to changes in Curriculum Development.
- The professional behavior change scale of Curriculum Development was most closely related to program components that focused on teaching techniques and content, both regionally and nationally.
- Those who were more satisfied with their participation in the program tended to make more Curriculum Development changes and to participate in Networking more than those less satisfied with the program.
- Those with higher incomes Networked more than those with lower incomes.
- The professional behavior change scale of Networking was closely related to the program component of regional networking.
- Those from the Northeast made more changes in Office Procedures than other regions.
- Those with affiliations with Non-Profit Agencies made more changes in Office Procedures than those without such an affiliation.
- Those affiliated with Educational Institutions implemented more changes in Office Procedures than those without such an affiliation.
- The topic of natural variability contributed most to changes in Office Procedures.

DISCUSSION

This video conference and regional workshops was an educational program not directly aimed at encouraging behavior change, yet participants implemented many behavior changes, both personal and professional, as a result of their participation. The following discussion is focused on the two themes of personal and professional behavior change.

Personal Behavior Change

Every personal behavior change measured, no matter how difficult or rare an occurrence, was implemented by at least 22%, nearly one quarter, of the respondents.

There are *four themes* that emerge from the relationships between the demographic characteristics and descriptive reports and the personal behavior change scales.

Personalizing Environmental Issues

The *first theme* echoes what other researchers have found, that making the environmental issue personal, whether in the form of perceived threat or ownership of the issue (e.g. Baldassare and Katz, 1992; Hungerford and Volk, 1990), encourages behavior change. Those who expressed a new sense of urgency in passing on this information made statistically significant gains in all the personal behavior change scales. But, American adults have a growing number of choices about where to expend their energy and focus to make an issue personal (Miller, 1991). There are increasing numbers of public causes and special interests that solicit both time and money (Thomashow, 1995). Many are two-job families, with responsibility to children and extended families and leisure time options are innumerable. So a choice is in order, since few individuals follow and participate in more than two or three of the major issue areas that are available to them (Miller, 1991) and they expend little effort on activities of little value to them (Bandura, 1991). Even with the conflicting demands on an individual's time and the variety of potentially interesting issues available, 64% of Americans express a high level of interest in environmental issues (Miller, 1991, p. 25) and ". . . the American public is already developing the values, and some of the conceptual tools, necessary for dealing with global environmental problems" (Kempton et al., 1995, p. 225).

Knowledge Acquisition

The *second theme* related to knowledge acquisition. It was found that acquiring specific content knowledge related to emerging scientific information was very important to personal behavior change. Participants with an education background made statistically significant gains in increasing their awareness and discussion of global change issues. The clear, understandable presentation of information on topics that had been confusing to the participants, such as, the greenhouse effect and ozone depletion, (Read et al., 1994; Kempton et al., 1995), as well as learning about already measurable impacts on the ecosystem were statistically significantly related to respondent gains on all three personal behavior change scales.

Increases in Confidence

The *third theme* that emerged was an increase in confidence related to both an understanding of the complexity of global change issues and in approaching additional content information. Along with those increases in confidence came significant changes in all the personal behavior change scales. Neither intention nor desire will result in responsible behavior change if individuals do not have confidence in their ability to choose appropriate actions. "Among the mechanisms of personal agency, none is more central or pervasive than people's own beliefs about their capabilities to exercise control over their own level of functioning and over events that effect their lives" (Bandura, 1991, p. 257). Increased confidence results in participants' determination to triumph over obstacles blocking achievement of their goals rather than being dissuaded by failures or difficulties (Bandura, 1991). This also applies to identifying ways to have some amount of control over one's behavior even in "environments containing limited opportunities and many constraints" (Bandura, 1991, p. 269). This is particularly important in the concept of learning to live sustainably since there are no clear directives on how to accomplish that goal. The behaviors that made-up the personal behavior change scales were not explicitly recommended behaviors but were the result of self-reflection on the content information and its application to personal behavior. Self-reflection is the first step to behavior change, but without knowledge and the confidence that knowledge engenders there is little basis for self-directed change.

National Perspective

Finally, gains in the personal behavior change scales were related to many of the program components that were

National in scale. It seemed important to the participants that they were involved in a program of national scale and that they were able to interact nationally, that they all received the same content information, and that they all were exposed to the same national demonstrations and teaching techniques. Knowing that a national network of interested others was developing was also important in encouraging increases in awareness and discussion of global change issues. Being part of a large, national program seemed to bring a seriousness and importance to the issue that enhanced the participants' sense of self-esteem and worth as well as their potential to have an impact on changing the projected environmental outcome. Societal codes and sanctions influence social conduct. Personal confidence was increased through increased knowledge, while the national perspective encouraged people to feel that the social environment was becoming responsive in encouraging and supporting environmentally responsible behavior changes. That national level of concern is implemented regionally and was shown in the responses to influence each region uniquely. Increases in ownership variables, particularly, content knowledge, self-esteem, worth and credibility support increases in empowerment variables, such as confidence and self-efficacy, which in turn lead to action (Hungerford and Volk, 1990). Also, according to Prochaska and DiClemente (1992), if the new behavior does not continue to be valued (in this case by society as well as the individual) then the behavior is likely to revert back or be difficult to maintain. The recognition of these issues as of national and global importance helps to support and maintain behavior change.

Professional Behavior Change

Of the professional behavior changes measured, more than half (56%) the respondents utilized some or all of the resource materials provided through the program and one third to nearly half the respondents developed and offered new programs or revised programs or curricula to include information from the Video conference. Again, regardless of difficulty, every measurable professional behavior change activity was implemented by at least 5% of the respondents. The themes that emerged related to professional behavior changes can be characterized by the three professional behavior change scales: curriculum development, networking, and office procedures.

Curriculum Development

Three factors seemed to influence the professional behavior change scale of curriculum development: confidence, content knowledge, and satisfaction. Development of confidence in talking about global environmental change issues and in approaching additional content materials was extremely important in encouraging changes in curriculum development. It is the rare person who is willing to teach something about which they have little confidence in their level of knowledge.

Content information, particularly in three of the five topical areas (natural variability, greenhouse effect, and population/resource distribution), was important to changes in curriculum development. An understanding of the topic of natural variability is at the heart of the global environmental change issue. A major focus of both national and international global change research programs is to clarify natural from anthropogenic influences on the Earth's climate system (Our Changing Planet, 1995). The greenhouse effect issue is one that promotes misunderstanding (e.g. Read et al., 1994) so that the incorporation of clear, concise content information into curriculum development in this and other areas could be helpful in answering many questions posed by students and the public. The issues of population and resource distribution help to clarify the causes of anthropogenic influences on the climate system. These three topical areas make the crucial connection between scientific knowledge and the environmental effects and consequences of human activities that are important to society.

The respondents who were more satisfied with what they learned at the National Informal Educators Videoconference made more changes in curriculum development than those who were less satisfied with the program. Satisfaction implies setting and attaining some valued personal standard. An overwhelming majority of participants indicated in the pilot survey that they were looking to attain both scientific (content) knowledge and an increased understanding of the complexity of these global environmental issues from this conference. Attainment of some level of their goal generated self-satisfaction and self-motivation to pass-on what had been learned and to continue the process of understanding and learning.

Networking

Three factors statistically significantly influenced the professional behavior change scale of networking: income, satisfaction with the learning that occurred from participation in the video conference, and the program component of regional networking. While other researchers have stated that behavior change, knowledge, and income are not positively related (Thompson and Stoutmeyer, 1991), increased income was found to be related to the professional behavior change scale of networking in this study. This is likely more related to professional seniority than to income per se. There is a certain professional level that must be attained before one can actually participate and benefit from networking. The authority to make decisions and the ability to develop and implement new programs comes with experience and so does income. Respondents who were more satisfied with what they learned from participation in the program increased their networking more than those who were not as satisfied.

Office Procedures

Three factors significantly influenced changes in office procedures, a professional behavior change scale: affiliation, the scientific content related to the topic of natural variability, and region. Those subjects affiliated with Educational Institutions or with Non-profit Agencies made more changes in office procedures than those without such affiliation. The affiliations of the respondents fell into three major groups: non-profit, education, and government. Of those three groups, presumably, the most institutionalized would be government, followed by education and finally non-profit agencies. It appears that the most changes were implemented in the least institutionalized of the affiliations that were, it is assumed, easiest to change. Content information in the topic of natural variability was significantly correlated with changes in office procedures. It could be that an increase in clarifying the roles of natural variability and anthropogenic activities in enhancing global environmental changes increased the understanding of the importance of applying this knowledge to making additional professional changes. Inappropriate behavior, in general, can be encouraged when any of the following are in effect: responsibility for the behavior lies elsewhere (i.e., with the institution); collective responsibility (everyone is responsible while no one is held responsible); when it is the norm (activities harmful to others occur because of social inducements); and when the recipients of the behavior are impersonal, strangers, or different (e.g. other living beings, the next generation, or those from developing countries) (Bandura, 1991, p. 281). Scientific information gained through program components of this conference effectively disengaged those inducements to inappropriate environmental behaviors by: personalizing the responsibility; and encouraging self-recognition of the environmental consequences of normative behavior. The Northeast region participants implemented statistically significantly more changes in Office procedures than the other regions. There was a higher percentage of non-profit agency participants from the Northeast (>56%) than from other regions which could support the affiliation finding.

CRUCIAL ELEMENTS

The methods used in this educational program and the findings from this study should be applicable to many developing global change education programs. There are four crucial aspects of this educational program that should be staples for any global environmental change education effort. The first must include an interdisciplinary perspective. Interdisciplinary perspectives are crucial to help individuals recognize that global environmental changes can be studied and understood from many disciplines, thereby increasing the approachability of the topic to a wide variety of individuals of varying educational backgrounds and levels.

The second important aspect to any global change education program relates to both a national and a regional dimension. The national dimension requires national participation and support and at the same time provides a broad social comparison for people to recognize their role in an important issue. The regional dimension brings the issues to a personal level, considered crucial to action.

The third important aspect is providing knowledge through understandable scientific content. Knowledge builds confidence that encourages risk taking in the form of environmentally responsible behaviors but must include clear connections to social impacts. For many, science and society have no connections. Those interactions must become explicit and thereby guide appropriate environmentally responsible behavior and policy choices.

Finally, using a multimodal approach with a variety of teaching techniques and demonstrations, including lectures, visuals, discussions, and hands-on activities, reaches a wide range of learners and models successful teaching strategies useful to a broad spectrum of educators.

CONCLUDING COMMENTS

This research inevitably suffers from the weaknesses inherent in mail response surveys. While there were 315 registered participants only 79 took the time to respond to the follow-up questionnaire, even with prompting. That number of respondents limited the sophistication of the statistical analyses that could be performed on the data. Also, those who participated were self-selected through an application process that makes the participants biased toward those already interested in such environmental issues rather than representative of the general public. However. the exploratory nature of the study has allowed a preliminary assessment of outcomes on important components of the program. The behavior changes implemented by respondents as a result of participation in the program were internally derived, self directed, and effective many months after the program, which leads one to suspect that they may be durable.

Humans do not live socially isolated and many of the environmental challenges and difficulties that we face into the future reflect group problems and will require sustained collective efforts to produce significant change. "The strength of groups, organizations, and even nations, lies partly in people's sense of collective efficacy that they can solve their problems and improve their lives through concerted effort. Perceived collective efficacy will influence what people choose to do as a group, how much effort they put into it, and their staying power when group efforts fail to produce results" (Bandura, 1982, p. 143). Building confident, self-efficacious individuals is a crucial step in collective efficacy. "Inveterate self-doubters are not easily forged into a collectively efficacious force" (Bandura, 1982, p. 143). Kempton et al., (1995) showed that environmental values were already integrated into core American views (p. 214) but that inappropriate behavior and policy choices were often made because what was lacking was the in-depth knowledge and understanding of consequences of those choices. This program presented up-to-date scientific information in a concise, understandable way that resulted in more appropriate choices for responsible environmental behavior.

Humans have spent most of their history living harmoniously with other species and with nature and the behaviors that are wreaking havoc on the planet and that we are working to change are relatively new. We must find ways to rethink our present activities and societal structures that support unbridled growth that results in unsustainable behavior. Interest or concern alone are not enough. Knowledge alone is not enough. Confidence alone is not enough. But, provide concerned and interested individuals with informative and applicable global environmental change education programs that build confidence and the result is responsible environmental behavior and choices. In the words of Baba Dioum (a Senegalese conservationist):

> We will conserve only what we love;
> We will love only what we understand; and
> We will understand only what we are taught. ❑

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Climate Change Knowledge and Attitudes: Links to Action in the Residential Sector

Ian H. Rowlands, Daniel Scott and Paul Parker

In Canada and many other OECD nations, home energy consumption is the largest source of greenhouse gas emissions that is directly actionable by individuals. This study examines the relationship between knowledge of, and attitudes toward, the climate change issue, and three types of actions to reduce greenhouse gas emissions in the residential sector (energy conservation in the home, willingness to pay for 'green electricity' and support for energy efficiency and green electricity policies). A mail-back survey was completed by 386 respondents from three cities (Waterloo, Kitchener, and Cambridge) in Waterloo Region (Ontario, Canada). The data indicated general concern for climate change and common misperceptions about the causes of human-induced climate change. Further analysis revealed a statistically significant, moderate correlation between the certainty that climate change would occur and actions to reduce greenhouse gas emissions. Importantly, this relationship was stronger for support of government energy efficiency initiatives than personal action or willingness to act. The paper concludes with some implications for communication strategies related to energy efficiency in the residential sector.

INTRODUCTION

Many authors maintain that effective action to mitigate and/or adapt to global climate change requires a citizenry that understands the issue, including the causes of climate change, global and regional impacts, and what could be done in response. Dunlap (1998, 490), for example, observed that, 'It is common for analysts to decry the limited level of public understanding of global warming, and to argue that effective policy-making and ameliorative action will hinge on efforts to enhance this understanding.' Similarly, Bostrom et al. (1994, 959) argued that, to a significant degree, '... the effectiveness with which society responds to this possibility [global climate change] depends on how well it is understood by individual citizens.'

Indeed, some suggest that there is a direct correlation between environmental knowledge and concern and environmentally responsible action. Nevitte and Kanji (1995) argued that greater 'cognitive mobilization' (which consists of greater interest in, and education about, the relevant issue) leads to greater environmental concern and greater environmental action. Blake et al. (1997) reinforced these findings. Kearney (1994, 41) asserted that without 'adequate knowledge an individual may not be confident enough to act or may not know how to achieve a goal.' In the context of global climate change, Bord et al. (1998, 79) cited their earlier work (Bord et al., 1997) and that by Kempton et al. (1995), to suggest that 'accurate understanding [of global climate change] correlates significantly with support for initiatives to mitigate global climate change.' There is, however, no unanimity about this. Staats et al. (1996) and Dunlap (1998), for example, have found the link to be more tenuous.

The influence of attitudes upon action (either by individuals or support for policy initiatives) has also been highlighted by many. Although a discussion of the environmental attitude and behaviour literature is beyond the scope of this paper, 'Reviews of the volume of work dedicated to assessing linkages between (general) environmental attitudes and proenvironmental behaviors have generally concluded that such relationships are rather tenuous' (Scott, 1999, 271). Specific attitudes (e.g., those toward solid waste or energy issues) have shown greater predictive value for related environmental behaviours. Within the context of climate change, Dunlap (1998, 474) argued that '... within the small but growing interdisciplinary community interested in the human dimensions of global environmental change it is widely agreed that public perceptions of global warming are important, for it is assumed that such perceptions will have an impact on policy-making.' There remains a need to further explore this relationship as it relates to individual behaviour (in addition to support for government policies to mitigate climate change).

The purpose of this paper is to explore the links among public knowledge of, and attitudes toward, human-induced global climate change, and the public's desire to take action to reduce greenhouse gas emissions in the residential sector. Our task is, as conceptualized in Figure 1, to examine the extent to which knowledge about global climate change and/or the confidence that global climate change will occur correlates with actions to reduce greenhouse gas emissions in the residential sector (any of personal energy conservation in the home, green electricity purchases and support for pro-active government policy).

The residential sector was chosen as an initial focus for public behaviour because it is the largest source of greenhouse gas emissions for which Canadians are personally responsible and is directly actionable by individuals. In 1996, the residential sector was responsible for 71.2 Mt of carbon-dioxide emissions (17% of Canada's total end-use CO_2 emissions) or approximately 6.2 tonnes per household. Research based on the national *EnerGuide for Houses* program suggests that average annual energy savings of 20% (1.2 tonnes per household) are possible.

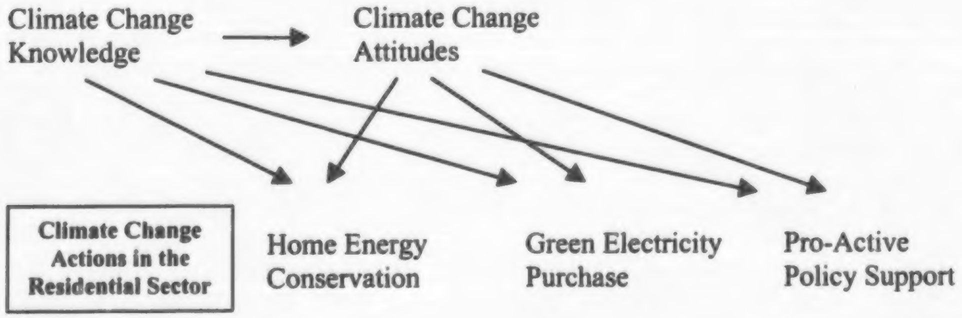
A 154-item survey instrument was designed to explore these questions in a mid-sized Ontario (Canada) community. The initial survey instrument was developed in accordance with the design principles outlined in Dillman (1978) and subsequently revised after a limited pretest (n=37). Individuals participating in a home energy evaluation program, through the Waterloo Region 'Residential Energy Efficiency Project' (REEP[1]) were asked to complete the questionnaire. Of the 830 questionnaires distributed, 386 were returned, for a response rate of 47%.[2]

This paper is divided into four main sections. After this brief introduction, the following section assesses respondents' knowledge of greenhouse gas sources and their attitudes towards global climate change. This analysis allows us to locate respondents along two axes, 'relative understanding of the causes of global climate change' and 'confidence that global climate change will occur.' In the third section, individual actions to reduce greenhouse gas emissions (specific to home energy use) and policy preferences are explored. The extent to which respondents who were classified as 'climate change-knowledgeable' or 'climate change-believers' are more likely to take, and/or to support, action on global climate change is then examined. The paper concludes with a summary of the main findings and implications for the promotion of energy efficiency programs in the residential sector.

KNOWLEDGE OF, AND ATTITUDES TOWARD, GLOBAL CLIMATE CHANGE

This section identifies the extent to which respondents are knowledgeable about the causes of human-induced

FIGURE 1 - Research Task


Climate Change Knowledge
Climate Change Attitudes
Climate Change Actions in the Residential Sector
Home Energy Conservation
Green Electricity Purchase
Pro-Active Policy Support

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global climate change and their attitude toward the issue (basically their confidence that climate change will occur and its salience as an environmental issue).

To explore individuals' understanding of global climate change, respondents were asked about the extent to which they thought that different human activities contributed to global climate change. Table 1 lists the percentage of respondents that identified each activity as being, either a 'major cause', a 'minor cause' or 'not a cause' of climate change.

The 10 activities are grouped together in terms of their relative contribution to global climate change: the first six listed are 'major causes' of climate change, the seventh (CFC emissions) is a minor cause, while the last three are not causes of climate change.

Only three phenomena were correctly identified by a substantial majority of respondents as major causes of climate change: driving automobiles, burning fossil fuels and deforestation. This finding is consistent with pervious survey work in Canada (see Dunlap, 1998, 483). Given the 'pollution' imagery associated with the first two of these activities, their correct identification is not particularly surprising. Bord et al. (1998, 78) reported that 'the pollution model guides perceptions of global warming ...'. The considerable media coverage given deforestation may explain its high rate of correct identification.[3]

Alternatively, a number of specific energy intensive activities (mining, smelting and refining metals, and pulp and paper operations) were not as widely perceived as being major causes of climate change. This suggests that many people have only a cursory understanding of what consumes major quantities of energy in our society.[4] The finding that heating and cooling buildings was not usually identified as a major cause is somewhat surprising, particularly given that the survey was carried out in the context of a home energy evaluation. Nevertheless, this finding is consistent with those presented elsewhere (e.g., Bord et al, 1998).

Closely mirroring findings from many other studies (Bord et al., 1998; Bostrom et al., 1994, and Kempton, 1997), the results confirmed that there is substantial confusion about the relationship between ozone layer

TABLE 1 - Estimations of Whether the Following are Potential Causes of Climate Change

Causes of Global Climate Change	Major cause	Minor cause	Not a cause
People driving automobiles	[illegible]	[illegible]	1 %
Burning fossil fuels (coal, oil, gas)	84 %	16 %	1 %
Deforestation / clearing the rain forest	80 %	18 %	2 %
Mining, smelting and refining metals	51 %	48 %	1 %
Heating & cooling buildings	[illegible]	35 %	7 %
Pulp and paper operations	[illegible]	54 %	7 %
CFC emissions	61 %	32 %	7 %
Depletion of the ozone layer	76 %	16 %	8 %
Use of nuclear power	15 %	48 %	36 %
Microwave communication transmissions	7 %	33 %	61 %

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People driving automobiles	**86 %**	**13 %**	**1 %**
Burning fossil fuels (coal, oil, gas)	**84 %**	**16 %**	**1 %**
Deforestation / clearing the rain forest	**80 %**	**18 %**	**2 %**
Mining, smelting and refining metals	**51 %**	**48 %**	**1 %**
Heating & cooling buildings	**38 %**	**55 %**	**7 %**
Pulp and paper operations	**39 %**	**54 %**	**7 %**
CFC emissions	61 %	32 %	7 %
Depletion of the ozone layer	76 %	16 %	8 %
Use of nuclear power	15 %	48 %	36 %
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depletion and climate change. More than three-quarters of respondents thought that depletion of the ozone layer was a major cause of climate change. Bostrom and colleagues believe that media accounts conflating the ozone layer depletion and climate change issues contribute to the public's misunderstanding; as a result, people tend to believe that global warming is a direct effect of holes in the ozone layer (Bostrom et al, 1994, 961).

Nuclear power was also identified as a cause of global climate change by 70% of the respondents. This again parallels results from the work by Bord et al. (1998, 78), whom argue that those 'who chose the generation of nuclear power as a minor or major cause of global warming are probably unfamiliar with this technology and may have been influenced by the large plumes of steam emitted by these facilities.' Another partial explanation for this misunderstanding came from a respondent who expressed concern over the effects of radiation from nuclear testing and nuclear power on the atmosphere.

Using the responses from these questions regarding respondents' knowledge about climate change, we assigned one point for each correct answer. Though more respondents 'passed' than 'failed' this simple test, the average score was only 4.8 out of 10 (with the median being 5 out of 10). In short, basic scientific literacy about climate change science remains a public education need. Figure 2 shows the distribution of scores.

We can compare these results with the extent to which respondents agreed with the statement that 'I am well informed about climate change issues.' Using a Likert scale (1 = strongly disagree through 5 = strongly agree), the vast majority of respondents placed themselves towards the middle of this scale, either agreeing (43 per cent) or disagreeing (43 per cent) with the statement. Five per cent of respondents strongly agreed that they were well-informed, while 3 per cent strongly disagreed.[5] People are generally able to 'read' their understanding correctly. The knowledge score and self-rating were positively correlated ($chi^2 = 0.26, p < 0.01$), with the group that either agreed or strongly agreed that they were well informed scoring 5.3, while those that thought they were not as well informed (either disagreed or strongly disagreed) scored an average of 4.6.

Knowledge of greenhouse gas sources does not necessarily correspond with an individual's attitude toward the global climate change issue. An individual may not necessarily understand the issue well, but nevertheless may

FIGURE 2 – Respondent Knowledge of the Causes of Climate Change

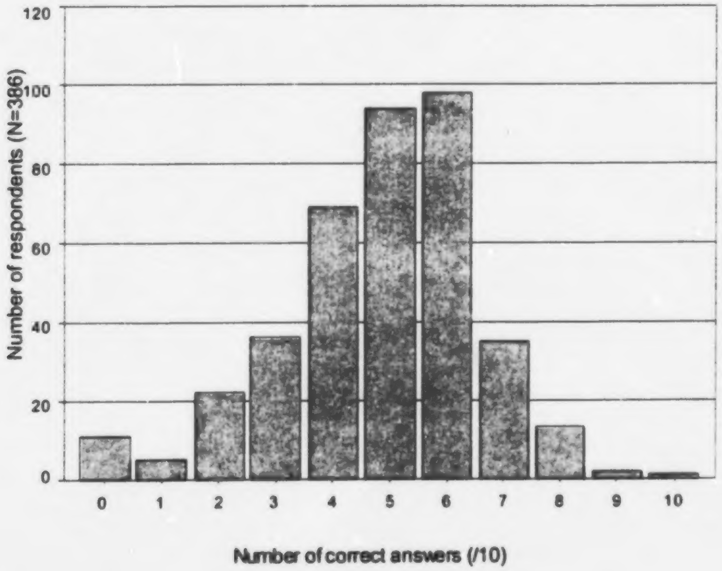

TABLE 2 - Profile of Climate Change Attitudes

Statement	Mean
So far, climate change seems to be mainly a theory. We shouldn't make major changes in our economy and our way of life based just on models and scientists' predictions.	4.13
I'm not overly concerned about climate change because it won't have any effects for 50 years.	4.10
Climate change has been blown out of proportion by environmentalists.	4.00
Scientists have [not] done enough research on climate change to start taking steps to reduce greenhouse gas emissions.	3.68
Climate change is [not] the most important environmental issue facing Canada.	3.19

believe that it is significant and important. Similarly, the inverse may also be true. Consequently, we also examined the extent to which people appeared to agree that global climate change is real and that it is a salient issue worthy of attention and action.

A scale of five items (Table 2) was used to measure climate change attitudes, specifically respondents' belief in the certainty of human-induced climate change and the salience of climate change as an environmental issue. Each of the five items was measured with a Likert scale and the scores of the last two items inverted so that a composite attitudinal score of 5 to 25 was possible (where 5 = climate change skeptic and 25 = strong confidence that climate change would occur)[6]. For all respondents, the average score on this scale was 19.1, meaning that the average respondent 'agreed' (for the most part) that climate change is real and a salient environmental issue. This level of agreement is consistent with the findings of Dunlap (1994), whom found concern in Canada to be amongst the highest in a 24 nation survey.

Are those more knowledgeable of the causes of human-induced climate change more convinced that it is a real concern? There does indeed appear to be a positive association ($\text{Chi}^2 = 0.28$, $p < 0.01$). Simply put, the more people understand the causes of climate change, the more certain they are it will occur and the higher their concern over the issue.

PERSONAL ACTIONS AND POLICY PREFERENCES ON GLOBAL CLIMATE CHANGE

To examine potential links between climate change knowledge and attitudes and actions to reduce greenhouse gas emissions in the residential sector, both personal actions and support of government initiatives were considered. First, respondents were asked the consistency with which they engaged in eleven energy conservation actions at home (90 per cent of the time = 5 on the scale through to 0 per cent of the time = 1 on the scale):

- Adjust thermostat when no one is going to be home or in evenings.
- Use less hot water (e.g., have shorter showers).
- Use fans and open windows instead of air conditioning.
- Hang clothes to dry instead of using clothes dryer.
- Close drapes during hot summer days.
- Adjust heating / cooling vents in rooms that are not in use.
- Turn off decorative lights / Christmas lights before bed.
- Turn off TV, stereo, computer when no one is using them.
- Wait for a full load to run dishwasher or clothes washer.
- Wear warmer clothes, so the thermostat can be kept lower.

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FIGURE 3 - Distribution of Home Energy Conservation Scores

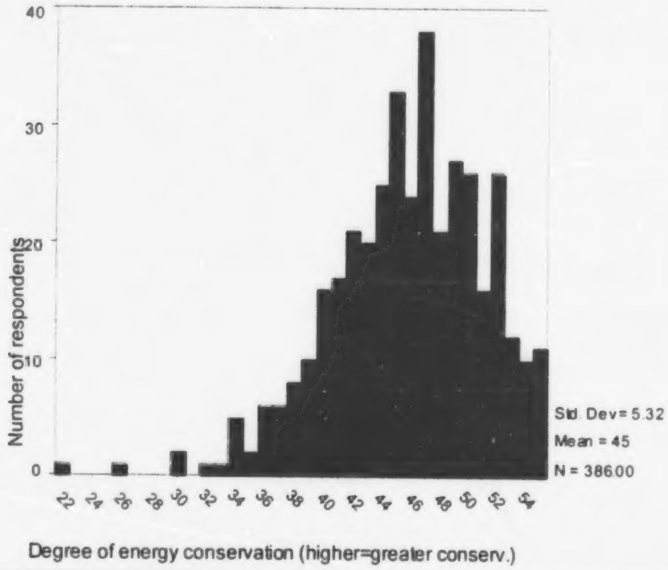

TABLE 3 - 'Available' Energy Packages

Fictional Company	Cost	Energy Profile			
		Nuclear	Mainly large-scale hydro	Fossil fuels (mainly coal)	Renewables (wind, solar, etc.)
A	**same as now**	50%	30%	20%	-
B	**25% more**	-	-	-	100%
C	**15% more**	-	40%	-	60%
D	**10% more**	-	70%	-	20%
E	**5% more**	-	90%	-	-
F	**5% less**	-	-	50%	-

- Turn off lights when no one is in the room.

To determine some measure of each respondent's energy conservation activities, responses to the eleven actions were summed. The higher the score, the more active the individual was at home energy conservation. For example, if a respondent engaged in all activities with 90% (or better) frequency, their score would be 55.

The average value for all respondents was 44.8 (Figure 3), meaning that, on average, individuals undertake energy conservation actions at home 'most of the time' (or 75 per cent of the time). Given that all of the respondents to this survey were having a home energy evaluation completed, this is perhaps not surprising.[7]

When the link between climate change attitudes and home energy conservation was examined a weak but significant positive correlation was found ($Chi^2 = 0.19$, $p < 0.01$). A similar analysis of climate change knowledge and this

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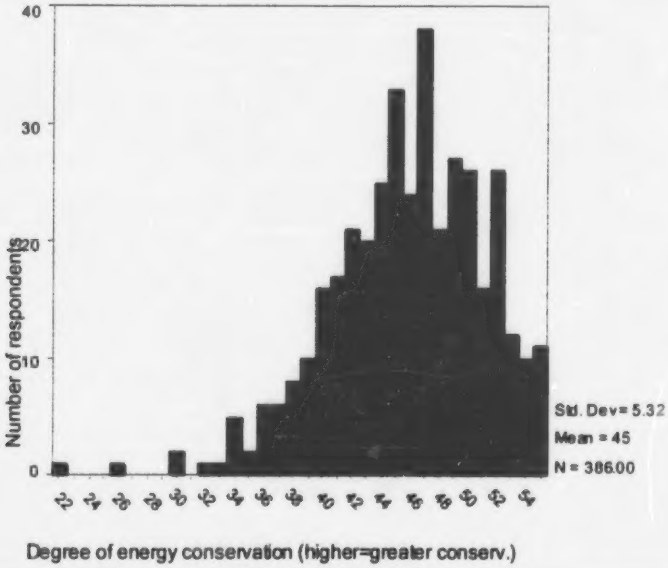

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When the link between climate change attitudes and home energy conservation was examined a weak but significant positive correlation was found ($Chi^2 = 0.19$, $p < 0.01$). A similar analysis of climate change knowledge and this behavioural measure, however, did not yield a significant correlation coefficient.

With electricity restructuring presently underway in the province of Ontario, residents in Waterloo Region will – beginning in November, 2000 – be able to choose their electricity supplier. Moreover, it appears that, if they so desire, they will be able to select a supplier based upon the environmental attributes of the technology used to generate the electricity they consume. In other words, those who want to mitigate global climate change by reducing their use of fossil fuels may be able to select a 'green(er) electricity' option in the near future. It is anticipated, however, that the cost of such electricity will be greater than that provided by conventional sources.

Respondents were asked consider the energy packages offered by six hypothetical companies (see Table 3) and indicate the package they would prefer. Both the cost and environmental profile were factors for consideration.

In terms of 'climate change action', we were interested in those people who chose any one of companies B, C, D or E as their preferred producer. In every case, it indicates that they would be willing to pay a premium (from 5% to 25%) for a less carbon-intensive energy package. Almost 80 per cent of all respondents stated that they would be willing to pay more for less carbon-intensive energy (Figure 4). This is comparable with findings in the United States (Farhar, 1999, 2). The other 20% of respondents chose either company A or Company F, signifying their desire to maintain the status quo or indeed reap monetary savings by switching to a more coal-intensive energy package (at the expense of global climate change).

Again, a significant positive relationship was found between climate change attitude scores and willingness to take action through the purchase of 'green(er) electricity' options ($Chi^2 = 0.22, p < 0.01$). A weaker, but significant correlation existed with knowledge of the causes of climate change ($Chi^2 = 0.13, p < 0.01$).

In addition to action (home energy conservation) and potential action (willingness to pay for 'green' electricity) of individuals, the study also examined the relationship between climate change knowledge and attitude and energy policy preferences. Participants were asked to express their opinion on a range of energy strategies that have been proposed for the residential sector in different North American jurisdictions. Considering the role

FIGURE 4 - Preferred Energy Package

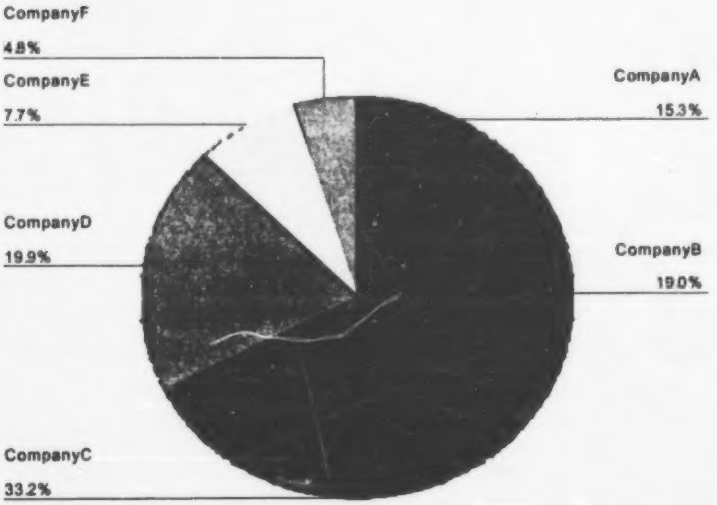

TABLE 4 - Preferences for Alternative Energy Policies (1=Not Preferred; 5=Highly Preferred)

Policy	Mean
Governments should implement stronger energy efficiency standards for new homes.	4.31
Governments should provide tax credits for homeowners who have improved the energy efficiency of their home by 25% or more.	4.19
Governments should place a small tax (5%) on all non-renewable sources of electricity and use the revenues to fund research and development into renewable sources of electricity.	3.73
Governments should legislate the minimum amount of energy from 'green' sources (e.g., 10% wind/solar).	3.52

that government should play explicitly, we used four policies that would indicate that respondents would like to see something done on the issue of global climate change (Table 4).

A Likert scale was used to measure respondent opinion on these four policy strategies. Responses were then summed into a score of willingness to support 'proactive' governmental energy policies related to residential sector (with 1 = least willingness to support such policies and 5 = greatest willingness to support such policies). Scores could range from 5 to 20 in total. The average score was 15.8, suggesting that respondents, on average, 'agree' that proactive energy policies should be pursued. In terms of individual popularity, Table 4 illustrates that the two energy efficiency measures have greater support than the two renewable energy measures.

Again, a statistically-significant association between climate change attitude and support for proactive energy policies was found (Chi^2 = 0.40, $p < 0.01$). The association between climate change knowledge and such support was also found to be weaker (Chi^2 = 0.21, $p < 0.01$).

SUMMARY

The purpose of this paper was to investigate the links among climate change knowledge, attitudes and action to reduce greenhouse gas emissions from the residential sector. More specifically, we were seeking to determine whether those who better understand global climate change, as well as those who are convinced global climate change will occur, are more likely to take action on the issue – either by engaging in personal action (by means of practicing energy conservation at home or by stating their willingness to pay more for 'green electricity') or by lending their support to proactive government policies. We summarize our findings in Table 5, below, in which the correlation (chi^2 value) between either 'attitude' or 'knowledge' and each of 'energy conservation', 'green electricity' and 'proactive policies' is presented. From this, a couple of findings are noteworthy.

In both cases – that is 'attitude' and 'knowledge' – the correlation is greatest with support for proactive policies on the part of government. What this suggests is that some respondents may feel that addressing climate change and energy challenges more generally is a collective, rather than an individual, responsibility. The finding that 30% of the respondents felt that addressing climate change is the responsibility of government and not a personal responsibility further supports this argument. Concerns about being taken advantage of by 'free riders' (in the language of the game theorists) may motivate this feeling.

As anticipated, the climate change attitude variable was more strongly correlated with the three types of energy actions than was the general environmental attitude variable. Nonetheless, this study found little evidence to suggest that the climate change issue is poised to inspire lifestyle changes by Canadians to reduce greenhouse gas emissions related to home energy use. Survey data and discussions with respondents indicate that the motivation

TABLE 5 - Correlation between Attitude/Knowledge and Action Variables

	Energy conservation	Green electricity	Proactive policies
Climate Change Knowledge	0.06	0.13 *	0.21 *
Climate Change Attitude	0.19 *	0.22 *	0.40 *
General Environmental Attitude [1]	0.11 **	0.17 *	0.31 *

* = $p < 0.01$
** = $p < 0.05$

to improve home energy efficiency and adopt less carbon-intensive energy sources is multifaceted and include the co-benefits of economic savings, home comfort and health, improved local air quality and climate change mitigation. In short, any communication program to promote individual action in the residential sector solely as a climate change mitigation strategy is likely to be ineffective.

In conclusion, our investigation of respondents' understanding of global climate change adds further evidence for the need of this conference to examine strategies to overcome misperceptions of atmospheric issues and better solidify links between lifestyle and global environmental issues through effective communication. ❑

FOOTNOTES

[1] This survey is part of a larger socio-technical analysis of residential energy efficiency, largely sponsored by the Government of Canada's Climate Change Action Fund and the Social Sciences and Humanities Research Council of Canada. More information about REEP may be found at http://www.fes.uwaterloo.ca/Research/REEP.html.

[2] As of April 20, 2000. A copy of the survey instrument is available from the authors upon request.

[3] Bostrom et al. (1994) also found a number of survey respondents identifying 'deforestation' as a cause of global warming. Additional questioning, however, revealed that respondents 'focussed on the loss of the air-cleaning capacity of forests, rather than their role in carbon dioxide sequestration' (Bostrom et al, 1994, 966).

[4] This study also found that the public has a flawed understanding of the sources of electricity that they consume in their homes. Only 38% of respondents correctly identified nuclear power as the largest source of electricity in their province.

[5] Interestingly, this suggests a lower level of perceived understanding than that found in a Canadian survey in 1992, at which time respondents were asked: 'Thinking about the issue of global warming or the "greenhouse effect", how well do you feel you understand this issue – would you say very well, fairly well, not very well, or not at all?' Although the wording is slightly different, the distribution of results – very well (13%), fairly well (47%), not very well (21%) and not at all (15%) (see Dunlap, 1998, 480) – indicate a greater perceived understanding of the issue than found in this study. The findings may reflect regional sample frames or perhaps that information campaigns by climate change skeptics have generated more uncertainty about the issue among Canadians (see papers by Dotto and McKenzie in this volume).

[6] Missing responses were assigned a neutral value of 3.

[7] We recognise that self-reporting about socially desirable behaviour may well be overstated (compare with Scott, 1999, 276). However, we assume that a similar degree of overstatement will occur among all respondents of this study.

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Developing a Measure of Public Understanding of Climate Change and Willingness to Act when Science is Uncertain

Rosanne Fortner, Jeffrey Corney, Jae-Young Lee, and Samantha Romanello

Before the 1997 Kyoto Conference, two parallel studies measured public understanding of climate change and willingness to act when the science presented in media portrays uncertainty. Study I examined the certainty with which media reported information. Study II assessed public knowledge about climate change, certainty about that information, trust in media, and willingness to act against global warming. Media reports were scarce; about half of the references to global warming were hedged. Newspapers hedged more than other print media and television. The audience (n=139) was fairly knowledgeable and certain about global warming. Knowledge was moderately related to willingness to act.

INTRODUCTION

One of the emerging environmental issues of the next millennium is global climate change (GCC), often characterized as "global warming." The fundamental premise of the issue is that increased anthropogenic contributions of greenhouse gases are changing Earth's atmospheric composition to the point at which global systems stand to be noticeably altered. The Intergovernmental Panel on Climate Change (IPCC), a group of about 2,400 prominent scientists from all over the world, regularly reviews the status of indicators and updates world governments as to the probabilities and uncertainties of coming changes. In its most recent report published in 1997, the IPCC stated "Future CO_2 concentration projections are subject to uncertainties arising from our incomplete understanding of the carbon cycle. However, uncertainties in the reductions in radiative forcing arising from the emissions limitation proposals are small" (1997b, p. 6).

The public and its governments look to the scientific community to provide accurate information and predictions of possible future scenarios on this and similar issues. However, the nature of science itself implies a level of tentativeness or uncertainty. The complexity of global climate change elevates that level. Even with the IPCC's consensus that human-induced global climate change is occurring, there are still many scientific uncertainties. The mass media are playing a significant role in establishing public opinion regarding global climate change and should portray the uncertainties and their implications, while bringing forward the weight of evidence provided by the IPCC.

RESEARCH QUESTIONS

1) How much information about global climate change is generally portrayed through mass media sources?
2) To what extent is scientifically uncertain climate change information being "hedged" in mass media sources?
3) What is the public's "attitude" toward uncertain global climate change information?
4) How does media exposure to climate change information relate to willingness to adopt environmentally responsible behaviors?
5) How does "attitude" toward climate change relate to willingness to adopt environmentally responsible behaviors?

STUDY I : MEDIA COVERAGE OF CLIMATE CHANGE

Primary questions: How much information about global climate change is generally portrayed through mass media sources? To what extent is scientifically uncertain climate change information being "hedged" in mass media sources?

Methods

The mass media sources most available in the Columbus, Ohio, market are the daily newspaper (*Dispatch*) and Columbus-based affiliates of the three major commercial television networks: ABC, CBS and NBC. Columbus audiences also use national media such as weekly news magazines, CNN and the New York Times.

Each student in a graduate research class reviewed how one type of media dealt with topics related to global climate change, specifically, how prominently the information within the medium was presented and what level of scientific uncertainty was expressed. Keywords sought through media archives and current editions were "global warming, " "greenhouse effect," "climate change," "Kyoto," "IPCC," and other frequently used combinations. Because of limitations of class size and term length (10-week quarter), only media reports from September 1 through November 15, 1997, were considered.

The media selected were examined for any portrayal of GCC information, specifically any occurrence of statements that closely related to one or more of the five content statements that were selected from official reports recently submitted by the Intergovernmental Panel on Climate Change (IPCC) (1997a), the United Nations Environment Programme (UNEP) and World Meteorological Organization (WMO) (1997), and the U.S. Office of Science and Technology Policy (OSTP) (1997).

The five issue statements were as follows:

1) Carbon dioxide levels in the atmosphere are increasing.

2) Global warming is affecting our weather.

3) The average global temperature is increasing.

4) Human-produced emissions are affecting global climate change.

5) Stricter emission standards would not adversely affect the economy.

Table 1. Hedged phrases in proportion to reports about selected aspects of global climate change in the mass media, September 1 - November 15, 1997

Media Sources Statements	Local Newspaper	National Newspaper	Popular Magazine	Professional Magazine	National TV News	Total
Carbon dioxide levels in the atmosphere are increasing.	4/7 (57.1 %)	29/49 (59.2%)	0/6 (0.0%)	2/10 (20.0%)	1/3 (33.3%)	36/75 (48.0%)
Global warming is affecting our weather.	17/41 (41.5%)	19/42 (45.2%)	2/4 (50%)	6/8 (75.0%)	10/16 (62.5%)	54/111 (48.6%)
The average global temperature is increasing.	10/16 (62.5%)	30/48 (62.5%	0/7 (0.0%)	5/10 (50.0%)	7/12 (58.3%)	52/93 (55.9%)
Human-produced emissions are affecting global climate change.	4/16 (25.0%)	52/67 (77.6%)	1/9 (11.1%)	3/7 (42.9%)	5/18 (27.8%)	65/117 (55.6%)
Stricter emission standards would not adversely affect the economy.	4/21 (19.0%)	35/58 (60.3%)	3/13 (23.1%)	3/16 (18.8%)	12/33 (36.4%)	57/131 (40 4%)
Total	39/101 (38.6%)	165/264 (62.5%)	6/39 (15.4%)	19/51 (37.3%)	35/82 (42.7%)	264/537 (49.2%)

In A/B (C), A: the number of phrases hedged; B: the total number of phrases related to the statement; C: %, A to B

For media items referring to at least one of the five statements, students recorded quantitative data on measures of prominence: position within the news "hole" (page number, order of broadcast, item length, photos used, etc.). They also recorded subjective data on the level of scientific uncertainty expressed, identifying phrases that were definite and those that represented forms of "hedging" (Myers, 1989). Hedging is using word choice to subtly present a more humble and cautious delivery of a relatively new proposition. Examples of hedging words include "seem," "suggest," "appear," "could," "might," "tentative," "uncertain." The researchers rated each GCC statement as either 1, hedged or 0, not hedged. These observations were then tallied for each of the five survey statements and totaled for each media source. Frequencies of statements and their corresponding certainty ratings were calculated and compared among the six representative media sources. Students cross-checked each others' data as they prepared their final reports to insure inter-rater reliability.

Results

Television. ABC Nightly News and NBC Nightly News combined broadcast 12 reports relating to GCC during the two and one-half month study period. Within those reports, 70 statements total were found related to one of the five GCC content statements. Thirty-five statements (50%) were rated as being hedged (Table 1).

Statements expressing economic impacts of stricter emission standards were most frequently carried by national television news programs (33 times). Statements regarding possible impacts of global warming on weather were most often hedged (62%). Television news on all three commercial networks was surprisingly devoid of coverage of the Kyoto conference during the study period.

Newspapers. The *Columbus Dispatch* and *New York Times* together published 35 articles which were closely related to GCC. These occupied approximately 0.1 % of the total potential news space. Within those articles, 365 statements were found related to the GCC content statements and 204 statements (56%) of those were rated as hedged. The *Columbus Dispatch* published 20 articles related to climate change and the five global change statements were mentioned 101 times. Thirty-nine statements (39%) of those were evaluated as being hedged. During the same period, 264 statements were found in the articles published by The *New York Times* and 165 statements (62%) of those were rated hedged. Considering the difference in the volume of the two newspapers, the percentage of phrases hedged would be a more valid criterion to compare them than the number of phrases. It appears that The *New York Times* introduced hedging phrases more frequently in dealing with topics related to climate change than The *Columbus Dispatch*.

Magazines. *Time* Magazine and *Newsweek* Magazine printed four articles relating to GCC, occupying approximately 7% of the total potential news space to be found within the ten issues of each magazine that came out during the study period. Within the four articles, 39 statements related to GCC were found and 15% were rated as hedged. Two leading science magazines, *Science* and *Nature*, which are both written for and by professional scientists, were also examined for the sake of comparison. These two were considered as sources more closely aligned with the perceptions of the scientific community, particularly regarding how they conveyed GCC information in terms of hedging or not. Of 14 articles related to GCC among the magazines, 51 statements related to this study were found and 37% were rated as hedged.

In both types of magazine, the statements related to impacts of climate change on weather patterns were found to be most frequently hedged and the statements dealing with economic impacts were most frequently discussed, but hedged the least (Table 1). However, professional magazines (37%) appeared to introduce hedging phrases more than twice as often as popular magazines (15%).

In summary, national newspapers and professional magazines are more likely to hedge their expressions on global climate change than local newspapers and popular magazines. In terms of hedging, television news programs (43% hedged) would lie between newspapers (56%) and magazines (28%).

STUDY II : TELEPHONE SURVEY OF PUBLIC REGARDING CLIMATE CHANGE

Primary questions

What is the public's "attitude" toward uncertain global climate change information? How does media exposure to climate change information relate to willingness to adopt environmentally responsible behaviors? How does "attitude" toward climate change relate to willingness to adopt environmentally responsible behaviors?

Methods

The survey was administered by class participants calling over a week in November 1997. Each student made 20 calls, using a systematic random sampling (e.g., beginning with seven randomly selected pages, every 14th listing until the required number of calls was completed). Business numbers were not called. Only individuals over age 18 were invited to answer the survey, and a maximum of two call-backs was attempted before a number was discarded. Based on the number of residential listings in the 1996-97 Columbus telephone directory (about 512,200), this method with 140 calls gives a confidence level of 91%. The study must therefore be considered a preliminary one with potential for expansion.

Items in the survey fit into one of four basic categories of items which were designed to address the research questions. The first category was focused on the respondents' exposure to various media, exposure to GCC information via those media sources during the past couple of months, and the respondent's trust in those media sources when acquiring GCC information.

The second was a series of five content statements which have been introduced for Study I. The statements were selected for their relevance as indicators of a respondent's understanding and acknowledgment of the presence and potential threat of human-induced GCC. Respondents were asked to decide whether each statement was "true" or "false." Next, respondents were asked to rate how certain they were of their answer, rated on a four-point scale, very uncertain to very certain.

The third category of questions listed a series of actions proposed as ways to decrease human impact on the climate. The action statements were selected to assess the range of willingness to perform "responsible environmental behavior" (Volk & McBeth, 1997). Consistent with this approach, those actions were further refined to represent five realms of social behavior: consumerism, politics, legalism, resource management, and education. Respondents were asked to express how willing they would be to perform the action described in order to reduce global warming, rated on a four-point scale from very unwilling to very willing.

The eight action statements were as follows:

1) Use public transportation more than you do now.
2) Install low energy light bulbs in your house.
3) Support an increase in gasoline prices.
4) Support lawsuits against emitters of greenhouse gases.
5) Vote "yes" on a ballot issue to reduce greenhouse gas emissions.
6) Plant more trees near your home.
7) Increase the amount of insulation in your home.
8) Support environmental education in schools.

Results

One subject was omitted from the study due to sample error, leaving a final sample size of 139. This sample consisted of 56 males (40%) and 83 females (60%). Their ages were evenly distributed in the categories from 18 to over 55, averaging within the category of 36-45 years of age. Eighty-six percent of the respondents at least graduated from high school or equivalent. A low negative correlation ($r = -0.2$, $p = 0.05$) was found between willingness to act and age. No other significant correlations were found in connection with other demographic variables.

Table 2. Audience knowledge and certainty about selected aspects of global climate change, with constructed variable Attitude under Uncertainty

Statements	True/False[+]		Certainty[++]		Attitude[+++]	
	True	False	Mean	SD	Mean	SD
Carbon dioxide levels in the atmosphere are increasing.	127 (91.4%) [+]	9 (6.5%)	2.91	.78	2.57	1.60
Global warming is affecting our weather.	116 (83.5%)	18 (12.9%)	3.16	.83	2.38	2.25
The average global temperature is increasing.	117 (84.2%)	17 (12.2%)	2.79	.87	2.14	2.00
Human-produced emissions are affecting global climate change.	126 (90.6%)	10 (7.2%)	3.09	.87	2.75	1.66
Stricter emission standards would not adversely affect the economy.	50 (36.0%)	86 (61.9%)	2.74	.85	0.74	2.79
Total means[++++]	107 (74.8%)	28 (25.2%)	2.94	.84	2.11	2.06

+ The sum of percentages of true and false would not be 100% due to missing values.
++ Certainty has been measured with a scale from 1 (very uncertain) to 4 (very certain).
+++ Attitude has been calculated with a scale from -4 (very negative) to +4 (very positive)
++++ All calculations related to total means have been based on data listed in the table.

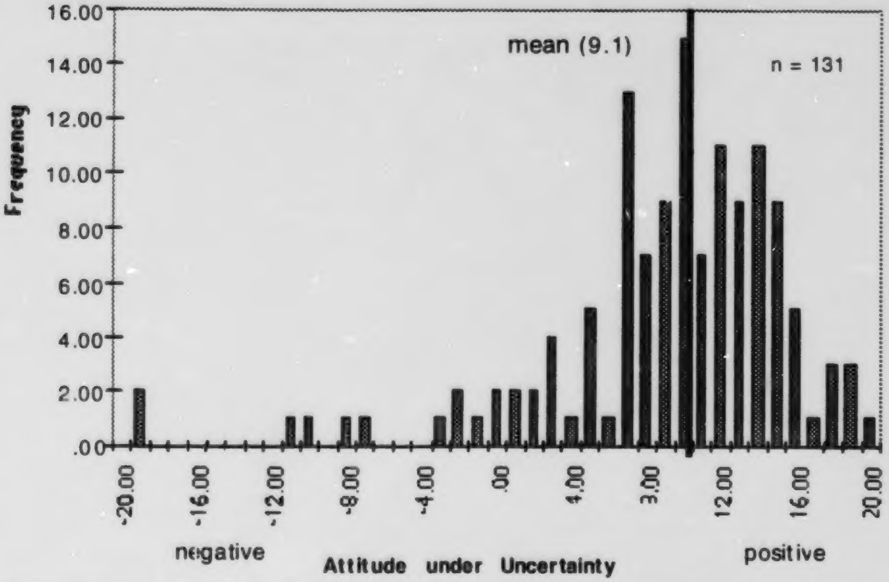
As for exposure to media and information about GCC, the respondents reported that they heard or read about GCC in their media sources an average of nine times per week during the two months preceding the survey. Their trust in what media said about global climate change averaged 58%.

The percentage of those who agreed to each of the five statements ranged from 36% to 91% (Table 2) and their combined mean was 77%. If the negatively stated economic impact statement were omitted, the mean for agreement would increase to 84%. The level of certainty (a 1 to 4 scale) ranged from 2.7 for the statement relating to economic impact of climate change to 3.2 for the statement about impact of climate change on weather patterns; the average of certainties for all five statements was found to be 2.9 (3 = certain). Considering both the degrees of people's agreement to the statements and certainty of their answer, people's perception of the economic impact issue of climate change must be more negative and tentative than for the other four issues.

In general, the scores of willingness to take action indicated that the respondents would be willing to adopt environmentally responsible behaviors to prevent global climate change. The behaviors most favored by the respondents might include support for environmental education in schools (3.6) and installation of low energy light bulbs (3.4). They are less likely to adopt the behaviors which could bring about direct, significant changes in their convenience and economic condition: support for an increase in gasoline prices (2.2) and use of public transportation (2.4).

A constructed variable "attitude under uncertainty" was calculated by summation of the true/false judgement and its certainty level for each statement. The scores ranged from -19 to 20 and their combined mean was 9.1, which indicates people confirm and are considerably concerned about the existence of global climate change and its possible impacts on ecosystem and human society.

Correlational analysis was performed for the six variables of education level, media exposure, media trust, media sources, willingness to adopt behaviors, and attitude under uncertainty. People's attitude toward global climate change appeared to have a statistically significant, positive relationship with not only their trust in media (r = 0.3,



p < 0.01) but also their willingness to adopt environmentally responsible behaviors (r = 0.4, p < 0.01).

DISCUSSION

Study I confirms earlier reports that "global warming" coverage is generally scarce. Hedging by the media was greatest in national newspapers and national television news, and the uncertainties may be been more salient than the urgency for action.

Individuals questioned in the audience analysis were fairly certain about the existence of global climate change and the effects it could have. Their certainty was related to how much they trust the media they use for information on the topic. It will be important, then, to examine more examples of media and how they are hedging in relation to complex environmental issues.

Considering the catalytic model (Trumbo, 1995) of media effects on the opinion construction process of the public, we can expect some negative relationship between media's hedging of the reports related to the climate change issue (Study I) and people's certainty of their knowledge of the issue (Study II). Despite some previous evidence, this assumption could not be fully supported nor tested by the findings of this study due to some constraints, including a small sample size and a short time-period.

It is possible that more advanced statistical examination could reveal that combinations of factors act together to reliably predict whether a person will be willing to act on an environmental concern if properly informed. Specifically, the relationship between perception of the problem as developed by media portrayal is worth a closer look. One could help develop more effective presentation methods to more accurately and fairly present environmental issues, maximizing public perception and consequent behavior. ❑

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Embracing Uncertainty in Climate Change Decision-Making

Tamara Levine

Climate change is expected to have dramatic impacts on natural, social and economic systems. Politicians and policy makers are faced with the challenge of weighing the costs and benefits of various policy options and making decisions to enhance the well being of humanity. In the face of incomplete understanding and the potentially severe economic costs associated with both mitigation and adaptation measures, many continue to argue the need to delay action until scientific uncertainties are reduced. This paper draws on numerous scientific, economic and ethical studies of the climate change phenomenon in order to demonstrate that it is imprudent and risky to delay climate change action on the basis of uncertainty. These analyses indicate that the economic and social benefits of immediate preventative action, such as the development of alternative energy and fuel technologies, typically outweigh the benefits of waiting for improved science. This paper examines the misinterpretation and miscommunication of available information as a potential cause of the current hesitancy to adopt meaningful climate change prevention policies. In light of the increased controversies created by inaccurate information, this paper examines means of improving the communication of uncertainty in the climate change debates and makes recommendations for an integrative approach to policy making in which uncertainty is embraced in precautionary policy actions aimed at mitigating climate change.

INTRODUCTION

The global question of appropriate climate change action has long included an extensive public debate surrounding the extent and reliability of current scientific information. This debate has been fueled by climate change communication that has so far focused on the inconclusive nature of scientific studies.

Organizations, most notably the fossil fuel industry, with a vested interest in climate change skepticism, have largely benefited from this discourse. These groups, threatened by the prospect of emissions reduction regulations, are fueling public mistrust in climate change science and urging governments to postpone emissions regulation until greater certainty is obtained (Robinson 1997; Singer 1997; Green 1999, Gelspan 2000).

This argument, to delay action until the evidence is conclusive, is based on two assumptions: first, that a higher degree of consensus can be reached about the nature and implications of climate change and second, that the risks associated with delaying action are less than the risks of taking immediate action on the basis of inconclusive or imperfect knowledge. Both of these assumptions overlook important information. Increasing evidence suggests that significantly greater certainty maybe impossible (Kay 2000; Broecker 1997; Malhman 1997; Darmstadter 1993) and that the risks of inaction are overwhelming.

INHERENT UNCERTAINTY IN CLIMATE ANALYSIS?

On November 07 1999, Calgary Herald published an article entitled "Give it up: Global warming theories rely on faulty data". This type of skepticism in the media is common in the fossil fuel depend province of Alberta. The anonymous author of this article points to the many shortcomings of current models as the basis for the claim that climate change is not happening.

Some of the content of this article is correct. Computer models are extremely useful tools for undrstanding climate change because they can integrate a large amount of information and mimic the action of complex climate systems. However, even these models have limits to the amount of information they can handle. The models are imperfect. However, modeling of highly complex phenomenon is inevitably imperfect. This does not mean that climate change research is "junk science" nor does it provide justification for a "wait and see" approach to climate change.

Predictive certainty is impossible. Uncertainty is a fundamental aspect of environmental policy making (Hammit 1990) and policy making on climate change is no exception. Understanding of this phenomenon is limited by the ability to collect, interpret (IGBP 1992) and communicate available information (Moss 1996) and inherent uncertainties arising from the complex, dynamic and non-linear nature of climatic systems (IPCC 1995).

As the IPCC has stated, "our ability to quantify the human influence on global climate is limited because the expected signal is still emerging from the noise of natural variability, and because there are uncertainties in key factors" (IPCC 1995).

The General Circulation Models (GCMs), advanced computer models that climate change researchers use to integrate and interpret available information, are, by necessity, simplified versions of the real world (Schneider 1990). The information used in climate models is based on assumptions and generalizations that overlook important stimuli and system interrelations (Goudie 1994). The models will always have margins of error and uncertainty in both the representation of current climatic conditions and the development of future projections because of their inability to incorporate adequate detail and complexity. (Darmstadter 1993; Rosenburg 1993).

Current models suffer from three main problems:

1. They have a limited ability to accommodate the dynamic nature of systems
2. They are unable to incorporate very small regional fluctuations
3. They presume more or less simple sets of cause-effect relationships when actual climate systems are complex and non-linear

1. Climate Dynamics

The earth's climate is not static. It has been and remains dynamic and evolving. As recently as 15,000 years ago, ice sheets more than two kilometers thick covered much of North America. These ice ages are the result of small temperature fluctuations, no greater than 4 or 5 degrees Celcius. (Crowley 1996). Past climate changes can be attributed to solar fluctuations, atmospheric turbidity, volcanic eruptions and other natural causes (Bauliunas 1998). Human contributions such as additions to atmospheric greenhouse gas concentrations do not act alone. They combine with natural factors in complex ways. With current technology, it is difficult to distinguish human induced climate change from natural variability, and to predict what natural factors will contribute to climate change in the future.

2. Regional Variability

The effects of climate change are not distributed evenly about the globe. Local conditions, air patterns and ocean currents greatly affect the nature and magnitude of change in a region. Current models can indicate that greater warming may occur at the poles; However, they are not detailed enough to predict specific effects in a given location. Regional variations are impossible to predict with current models because certain key components of regional climate systems, such as clouds, are too small to be incorporated into even the most detailed climate resolutions (Barron 1995).

3. Complex, and Non-Linear

Global Climate Change is not a simple incremental increase in temperature proportional to increasing carbon dioxide concentrations. (Schimel 1990). The natural, social and economic systems that affect and are affected by

Feedbacks in the Natural Environment:

Region	Positive Feedback	Negative Feedback
Atmosphere	Clouds are composed of water vapour which is a greenhouse gas, the gas will trap more heat in the atmosphere. Increased storms will return the heat to the earth during the formation of precipitation.	Convection currents will carry heat away from the surface of the earth slowing global warming Clouds have particulate matter that will reflect ultraviolet radiation Storms will absorb excess energy in the form of latent heat during evaporation
Oceans	Thermohaline circulation in the ocean may change warming surrounding land masses Warmer oceans hold less CO_2 resulting in a release of more CO_2 into the atmosphere	Thermohaline circulation in the oceans may decrease resulting in the cooling of surrounding land masses
Cryosphere	Melting of ice and snow will decrease albedo increasing the amount of radiation absorbed by the earth. The melting of hydrates may release large amounts of methane.	Icebergs will float free increasing the albedo of the earth and reflecting more radiation.
Biosphere	Increased growth of vegetation will result in a decrease in albedo resulting in a warming of earth's surface.	Increased temperature will result in a higher rate of photosynthesis and increased growth in the biosphere. This growth will result in an increased demand for carbon dioxide and the subsequent diminishing of the amount of GHG in the atmosphere.

climate change are interrelated and interdependent. Climate change prediction requires an understanding of the complex interactions between natural components of the climate system such as the oceans, the atmosphere, the cryosphere, land masses and the biosphere (Rosenburg 1993) as well as human responses developed in social-political and economic systems. Temperature, sea level, precipitation and other climatic conditions are influenced by positive and negative feedback mechanisms that amplify or diminish initial stimuli.

For example, an initial increase in global temperature caused by global climate change will result in increased evaporation and cloud cover, melting of the glaciers that make up the cryosphere, increased growth in the biosphere, and changes in atmospheric and ocean circulation patterns that will serve to enlarge or attenuate the initial temperature change.

The chart above outlines only a few of the mechanisms that have been identified. These responses make it very difficult to predict how changes in one stimulus will be manifest in the natural environment. Generally, it is expected that these mechanisms will result in an overall positive feedback or greater disturbance of current climate systems. However, there are still many uncertainties in determining the timing, magnitude and regional implications of various feedbacks (Goudie 1994).

This complex reality of dynamic feedbacks is greatly exacerbated by the non-linear nature of climate systems (Darmstadter 1993). A response within these systems is not always proportional to a stimulus. For example vegetation growth in the biosphere is not directly proportional to carbon dioxide concentrations. Some plants may not be limited by the availability of carbon dioxide, other plants may have a threshold level beyond which increased concentrations of the gas no longer affect growth or increased growth may cause competition and die-off in closed stands, counteracting the effect of increased growth. (Waggoner, 1993).

Due to these complex, non-linear interactions, biophysical systems are characterized by emergent properties and surprise (Kay 2000). In essence, climate and other related systems are more than the sums of their individual parts. Different components combine to create emergent properties that cannot be predicted from an understanding of the initial factors and some aspects appear to be inherently unpredictable. The problem therefore is not just that our current understanding of these systems is limited but that our understanding will always be limited by complexity and inherent uncertainties.

One of the most significant implications of complex and non-linear climate interactions is that climate change may occur much faster than usually predicted. The majority of policies to date have been based on the assumption that climate change will occur gradually over hundreds of years, giving us time to adapt. (IPCC, 1995). However, increasing evidence suggests that complex systems, such as the climate may change from one state to another very rapidly (Calvin 1998; Broecker 1997).

This climate system is maintained around a set of "normal" temperature and weather patterns by positive and negative feedbacks involving the atmosphere, the oceans and other aspects of the biophysical environment that amplify or diminish irregularities in the climate system (Hollings, 1986; Kay 2000). Ice core analysis and scientific assessment have indicated that there may be several "natural" states of global climate systems and that system perturbations can "flip" climate systems surprisingly quickly from one "normal" state to another that is quite different. (Broecker 1997). Generally the feedback mechanisms will return a disturbed system to its original state. But significant and persistent changes in important conditions (e.g. significant and sustained increases in greenhouse gas concentrations) can push a system beyond its range of adjustments and over a threshold toward more dramatic change. The system, seeking a new thermodynamic balance, must re-organize itself, often through quite rapid change and into a form quite different from the previous one (Kay 2000).

Recent ice core and sediment analyses have revealed that many historical climate events such as the ice ages may have been the result of sudden climate flips. Many of these changes have been associated with changes in ocean circulation. Ocean circulation is controlled by the density of water. Water is most dense at four degrees celcius and high salinity. This dense water sinks to the bottom of the ocean creating movement of water.
Dense water can be created in many different places. Therefore there are multiple stable states of thermohaline circulation. The last ice ages may have been caused by an abrupt transition in the flow of the North Atlantic Current. The warm Gulf Stream flows Northward to beyond the British Isles, warming Europe. However, a change in salinity and associated change in water density may have weakened this current preventing it from reaching as far north. This may have resulted in cascading changes in ocean current regimes and a rapid progression of the ice ages (Broecker 1997).

The accumulation of greenhouse gases in the atmosphere may be a trigger for rapid climate transitions. While it remains possible that change will occur gradually it is at least equally probable that sudden system flips will occur (Broecker 1997). The difficulty in climate modeling is that we do not know where the thresholds that determine the state of a climate system lie. Therefore we cannot predict when this change will occur. Furthermore, we do not have the ability to foresee what the nature of the future climate system will be. Consequently we cannot know how inhospitable to humans it may be. Our current climate may be an oasis in the midst of a desert of uninhabitable climate states.

The potential for rapid changes or flips may pose a much more serious threat to humanity than the usual assumed gradual climate change. Flips threaten major new challenges and very little time to adapt. In light of the risks associated with inaction and the potential for large-scale and rapid climate change, it is prudent to adopt policies aimed at significantly reducing the production of greenhouse gases. In other words, the presence of uncertainty and the possibility of surprises in climate responses to increased greenhouse gas concentrations should be an impetus for action, not a justification for inaction.

This argument for immediate action emerges readily from application of the precautionary principle. This principle states that we should err on the side of caution, especially when what is at risk is very valuable and where the possible effects are likely to be irreversible. To continue to avoid strong GHG reduction measures on the basis of uncertainty is highly risky. The climate systems we are altering are crucial to the maintenance of life as we know it. Potential effects of these changes are both severe and irreversible, especially if a climate system flip is involved. Due to time lags in the implementation and effectiveness of policies, there may be little time to act before the option of mitigation is foreclosed. Although increased technological development, scientific investment (IGBP 1990), cooperation and enhanced communication, such as adoption of a universal indicator of the level of certainty (Moss 1996), may eventually reduce some uncertainties, this will take decades. In 1990 the IPCC predicted that it would take 10-20 years before significant scientific agreement would be achieved. However, now in 2000 we see little indication of forthcoming certainty. By the time we receive a clearer indicator of climate effects, it may be too late to take the necessary action to prevent or adapt to climate change. Therefore it is essential that we begin to adopt strong measures aimed at mitigating climate change.

EXAMINING RISKS: AN ARGUMENT FOR ACTION

The concept of complex systems with many steady states and associated uncertainties has interesting implications for humanity. The first is that science cannot provide a clear indication of a right or wrong decision path. Biophysical systems evidently have multiple possible "normal" states. Scientific and economic assessments can describe a range of options and some of their implications but ultimately decisions among these options depend on ethics, morals, and human values.

Despite imperfections in climate models there is substantial evidence on which to base policy decisions. The analysis of available studies suggest that immediate action aimed at reducing greenhouse gas emissions is desirable for at least three reasons.

1) The risks of inaction based on current models is great
2) In light of uncertainty the risks are even greater
3) There is a moral obligation to take action
4) Action aimed at reducing greenhouse gases may be inherently beneficial to society regardless of their impacts on climate change

Risk

Current models predict that global climate change, even under the optimistic scenario of linear changes, will have effects on the biological, chemical and physical aspects of the earth that will be mostly detrimental to humans. These include the altered composition and distribution of terrestrial and aquatic ecosystems, (IPCC, 1995) and with possible loss of ecosystem integrity (Kay, 2000). The reduction in species diversity in aquatic and terrestrial systems will result in fewer resources for the ecological re-organization and response to future catastrophe, and fewer medicinal plants. The decreased extent of forest cover and the change in aquatic systems will mean reduced sources of wood, fiber, food, energy and other resources that are critical to global economies. This may result in increased desertification, and decreased bio-diversity. Climate change is also predicted to increase the frequency and severity of extreme weather events (Dotto, 1997). The changes in weather patterns will have severe effects on agriculture. (IPCC, 1995). Increased temperatures from global warming will result in a melting of ice caps leading to sea level rise of 15 to 95cm. This sea level rise will be detrimental human infrastructure and displace many people. Lastly, climate change is expected to result in increased heat waves and associated mortality from heart and respiratory illnesses and to increased mortality from the spread of vector born tropical illnesses such as malaria, dengue, yellow fever. (Epstein, 1990)

It is possible that the current models have over-estimated the effects of climate change. However, uncertainty is bi-directional and the effects of climate change could also be more severe than projected. "The sword of uncertainty has two blades: that is, uncertainties in physical or biological processes which make it possible for the present generation of models to have overestimated future warming effects, are just as likely to have caused the models to have underestimated change." (Schneider 1990) The risks of inaction could also be even greater than projected.

Most published trends depictions have been extrapolated from historical climate data and present model scenarios. The complex, non-linear nature of climate systems described above indicates that there may be significant outliers to these trends, such as climate flips. While these events are no more likely than linear climate change, they are potentially more damaging.

Moral Reasons

The ability of humanity to adapt to climate changes effects will depend on the vulnerability of regional populations, and the rate of change. The most vulnerable people in developing nations who have poorer nutrition, infrastructure, and technology to prevent and adapt to climate change will likely suffer the most. It is easy for us in our largely artificial environments to ignore the pressing problem of climate change but to many people, fluctuations in weather are the difference between life and death. Change may be gradual enough to allow adaptation within the developed world. However future generations may be left to deal with complex environmental problems they did not create. For this reason, it seems there is moral imperative to take immediate action. (Dotto 1993)

Societal Benefits

The needed action is significant. Some suggest that 70% reductions in greenhouse gas reductions will be required halt the current warming trend by the middle of this century(Gelspan 2000). The current challenge is finding effective, economical and socially beneficial means to make deep emission cuts. To date Canada has adopted "wait and see policies. Voluntary initiatives, the primary tool for greenhouse gas (GHG) reduction in Canada, have been criticized both in the press and in the environmental community for being, for the most part, ineffective in combating global warming (Hornung, 2000).

Effective action to achieve major greenhouse gas abatement will require mobilization of a wide range of policy tools and technological alternatives. Such as:

- Changes in subsidies or tax structures to minimize the use of fossil fuels and encourage innovation in alternative energy creation,
- The use of market mechanisms such as emissions trading and Joint Implementation Measures,
- The development of education programs aimed at energy efficiency and/or strict regulations
- The active participation of industries, corporations, individuals and their communities in programs aimed at reducing the use of fossil fuels.

No doubt, some substantial costs will be involved. But effective action for greenhouse gas emission abatement can also have a wide range of social and economical benefits. Climate change may perhaps provide the impetus for structural changes in our energy use patterns that should have occurred years ago. The application of alternative fuels technologies can create jobs, encourage global cooperation and reduce air pollution that has been associated with severe health problems. Furthermore, alternative energy such as solar, geothermal, and wind are renewable sources and therefore provide society with a reliable and sustainable source of energy.

In designing new mechanisms to deal with climate change, it is essential that we recognize uncertainty. If we adopt policies entirely based on current prediction, without recognizing the possibility of unpredictable events, we may be inadequately prepared to deal with surprises. Policy prescriptions must recognize the potential for unexpected events outside our current expectations. Our institutional and policy responses should be designed for flexibility and adaptation, and carefully monitored to identify needs for adjustment or replacement.

There is no doubt that these measures will be a challenge to our current society. However, human ingenuity is capable of achieving these reductions with mostly beneficial results.

CONCLUSION

Although uncertainty is a challenge to prescribing appropriate climate change action, it is a reality that must be accepted. Skepticism about our current understanding of climate change, generated in part by the biased media reporting on uncertainty, is delaying the implementation of effective climate change policies (Mahlman 1997; Dotto 1999). Current attention both in the media and the political arena should focus less on scientific uncertainty and more on possible action.

Significantly greater certainty, if it is at all possible, will take decades to acquire. Even then it is highly unlikely that we will ever obtain the degree of confidence on the details that is demanded by the vested interest groups now resisting action on greenhouse gas emissions. These groups seem likely to accept the need for action only when severe climate change compromises their own well-being. By then drastic climatic change will be irreversible and disastrous. We are dealing with a phenomenon that has the potential to alter the planetary conditions upon which life as we know it relies. Those who demand certainty want evidence that only a post-mortem may provide

We are both the doctors and the patients – our diagnosis suggests that the planetary conditions essential to life are changing – treatments are available but this ailment has never been treated – there have been no precedents – the choice is clear – do we act now or leave future generations to deal with the autopsy reports? ❑

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Session E4

STAKEHOLDER ENGAGEMENT 1: YOUTH AND EDUCATORS

Engaging the Public: Starting with our Children
Catherine O'Brien[1] *and Bernadette Kowey*[2]
1. York University
2. Way to Go! School Program

Greenhouse Gas Reduction in Canadian Schools
Eric Foster
Dearness Environmental Society

Youth in Media – Engaging Youth in Change
Peter Campbell and Kathryn Molloy
Youth in Media–Action on Climate Change

Engaging the Public: Starting with our Children

Catherine O'Brien and Bernadette Kowey

Recommendations for public education and outreach are integral to most reports regarding climate change and sustainable transportation. Reducing the number of kilometres driven has been identified as an important target for reducing greenhouse gas emissions. Children are proving to be a critical link to changing driver behaviour. Evidence and experience is presented from the Way to Go! program in British Columbia. Building on this knowledge is fundamental to establishing an approach to a regional or provincial program to create an ongoing, enduring change in travel behaviour.

The impacts of cars on children are presented with information that indicates that parents are not well informed on this topic. However, once they are given the information, and access to programs such as Way to Go!, parents are often motivated to change their behaviour.

INTRODUCTION

"Families share only 'leftover' time", is the title of a recent article in the Ottawa Citizen. It outlines a report from the Vanier Institute for the Family which tells us that "the stress of modern living leaves parents too drained to enjoy the time they spend with their children". Even though our children are so precious to us, most parents are struggling to simply spend a little time with their children. How can dire warnings of pending climate change and disaster for future generations penetrate this scenario?

The Way to Go! program in British Columbia and Greenest City's Active and Safe Routes to School begin with existing concerns and motivations of parents around safety. Parents who join the Walking School Bus take turns walking children to school, spend "quality time" with them, reduce their own stress through exercise - and leave the car at home. Imagine these programs sweeping across Canada and we have a major influence on greenhouse gas reductions while improving the health and well-being of Canadians.

Furthermore, engaging parents and children in active modes of transportation is one strategy for skirting the "uncertainty trap" about global warming.

The debate over global warming has been badly derailed by the "waiting for proof" argument, abetted by the refusal of policy makers, the media and the public to deal realistically with scientific uncertainty and their failure to deal with the question of risk (Dotto: 2000:9).

We have irrefutable data about the impact of cars on children and parents are demonstrating that his does grab their attention and change their behaviour. In other words, we don't have to believe in climate change in order to reduce greenhouse gas emissions. However, the broad impacts of cars on children is not well understood by the public. Increasing this awareness may not only lead to widespread changes in driving behaviour but may also create a "cultural shift" towards more sustainable transportation. Skeptics of climate change would have difficulty refuting the present and long term impact on children of our "business as usual" approach to transportation.

SUSTAINABLE TRANSPORTATION AND CHILDREN

Reports from the Transportation Climate Change Table, the National Roundtable on the Environment and the Economy, the Centre for Sustainable Transportation, and many others, have outlined the pressing need to move towards more sustainable transportation in order to reduce greenhouse gas (GHG) emissions.

Technology based solutions are being explored but it is widely recognized that few can offer the immediate solutions which are required (apart from low technology solutions such as removing barriers to walkable communities and cycling).

> Passenger travel represents a particularly important area in which to reduce emissions from transportation. It accounts for the bulk of transportation GHG emissions, but also presents a challenge in changing the travel, commuting and living habits of Canadians (Transportation Climate Change Table: vi).

While many technology solutions are welcome, it is important to question whether a sustainable transportation future simply involves a transfer of our auto-dependency to cleaner vehicles. Research regarding the impacts of cars on children suggests that reducing our car use is also an important goal. Technology that improves air quality will mitigate some of the negative impacts on children. However, we may anticipate that the acceptability of cleaner vehicles will reinforce auto-dependency. The sedentary lifestyle that children and youth have adopted, the number of traffic fatalities and injuries, restricted independent mobility and impoverishment of childhood experiences are likely to persist. Therefore, our efforts towards technology-based solutions must be coupled with strategies to influence driver behaviour.

Proposals for more compact, mixed-use communities, increased used of public transit, user fees, and trip reduction are all tied to the need for greater public awareness and education. A critical question then is how do we educate for sustainable transportation and also influence driver behaviour?

O'Brien's preliminary research suggests that parents are deeply concerned when they learn about the impacts of cars on children - however, few are aware of the extensive nature of these impacts. While public outreach strategies have focussed on convincing people to reduce the number of kilometres they drive, become more physically active, and run more fuel efficient cars, the role of children has often been overlooked. There is a need to raise the profile of children in sustainable transportation planning and climate change education.

Impacts of Cars on Children

A review of the literature on children and transportation indicates that most articles address several impacts of cars on children, including youth. Often the points that are stressed relate to rising levels of obesity, traffic fatalities, risks associated with physical inactivity and air pollution. The impacts are far more comprehensive and may cause us to explore the responsibility that we as a society may have for putting childhood at risk.

The following is a brief overview of the impacts of cars on children:

- Traffic fatalities are the leading cause of death in Canada for children over the age of one year (Canadian Institute for Child Health, 1994);
- Less than half of Canadian children now walk to school. This figure drops to 10% in the United States (Go for Green, 1998; Centers for Disease Control and Prevention, 1998);
- 2 out of 3 Canadian children do not meet average physical activity guidelines to achieve optimum growth and development (CFLRI, 1995);
- More than a quarter of Canadian and American children and youth are overweight (CFLRI, 1997; Centers for Disease Control and Prevention, 1998);
- Heavy traffic has reduced the independent mobility of children and youth; (Tranter, 1996; Hillman, M. and Adams, J., 1992);

- Opportunities and locations for spontaneous play are severely restricted by traffic; (Hillman, M. and Adams, J., 1992; Garbarino, 1989);
- Children who survive traffic accidents may suffer from emotional distress for a considerable amount of time, unless treated. This may include depression, recurring nightmares, difficulty attending to school work, fear of cars (Canterbury, R. and Yule, W., 1996);
- There appears to be no threshold for ozone levels that are safe and children are particularly susceptible (Transportation, Air Quality and Human Health Conference,1996);
- Children may be more vulnerable to airborne pollution because their airways are narrower than those of adults (Transportation, Air Quality and Human Health Conference,1996);
- Children also have markedly increased needs for oxygen relative to their size. They breathe more rapidly and inhale more pollutant per pound of body weight than do adults. In addition, they may spend more time engaged in vigorous outdoor activities than adults (Transportation, Air Quality and Human Health Conference,1996);
- Exposure to traffic noise has been linked to reduced reading levels in children - possibly due to reduced auditory discrimination (Bronzaft, A. ,1995);
- In Canada, approximately 30% of greenhouse gas emissions come from transportation. These are contributing to global warming which will have long term impacts on children (NRTEE, 1997).

Canadian parents were presented with this information in both a rural and urban focus group and asked for their response. They were visibly disturbed and commented that most people are likely unaware of this information. The points which seemed to be the greatest concern for them centred around the loss of spontaneous play opportunities and restricted independent mobility. They clearly related the information to their own children and struggled with the realization that their children are not having the quality of life which they, as parents, are trying to offer.

Their children no longer find walking normal and complain if asked to walk short distances, unless they are in a natural park setting. Parents talked about their fear of allowing their children to move around independently in the neighbourhood. They wonder at what age it will feel safe to permit this and how their children will develop the skills to deal with their environment alone. One father spoke of his son's need to socialize with his friends and realized that this is completely dependent on the availability of parents to drive.

When asked if a week-long campaign highlighting the impacts of cars on children would change driving behaviour the focus group participants stated that it would probably change only a few people. They recommend that the information should be presented many times over until it is common knowledge. The greatest impact, they feel would come if their children asked them to drive less. Parents suggested that children should be learning about sustainable transportation at school and influencing their parents.

It's interesting to note that parents responded to the less tangible, qualitative impacts of cars on their children. This is an area that has received little research attention. Cars and the impoverishment of childhood experience has been raised by Sandqvist (1998).

> From children's point of view, cars and traffic in neighbourhoods is deleterious and undesirable... children lose opportunities for learning from first-hand interaction with the real world and with adults and other children in their neighbourhood. Modern children increasingly live a world of vicarious experience provided by television and computers (p.4).

WAY TO GO! SCHOOL PROGRAM

"small steps towards a big difference"

Background: The School Run

There have been significant changes in transportation choices over the past two decades, across Canada, and indeed throughout the (over)developed world. Journeys that were once walked or biked are now being made by car. In North America, it is estimated that vehicles are driven approximately two thousand trips that are three kilometres or less each year. This averages out to seven short trips a day. Short trips are more polluting, as it takes a significant distance (up to five kilometres) before most cars' engines warm up enough for the emissions control systems to begin to work efficiently. Reasons for this trend are not entirely clear, but the 'car culture' that has affected rates of car ownership, and housing development that leads to urban sprawl, all contribute to increasing car-reliance. Per capita car ownership in Canada has risen from 310 vehicles per 1,000 people in 1970 to 484 per 1,000 in 1994 (Environment Canada, 1998).

Land use planning, and the continued development of low density, suburban housing has also contributed to the increase in car dependence. People no longer expect to be able to walk to their destinations; they automatically get into their cars to travel everywhere even when the location they are accessing is a short walk away.

Nowhere is this trend to drive (instead of walk or bike) to local neighbourhood destinations more apparent than when one considers the trip to school. What was once a child's independent journey, taken with siblings and friends has now become a car journey for many students, resulting in seriously congested school sites, children who are less active in their daily life and less apt to learn pedestrian or bicycling skills. The school trip results in more noise and traffic danger in local neighbourhoods, and contributes negatively to air quality and climate change, particularly as these are higher polluting short journeys. If these trips are chauffeur trips-trips dedicated specifically to taking a person or persons to a destination, and then to picking them up again-they require twice as many trips to accomplish that goal.

In 1994, the Greater Vancouver Regional District (GVRD) documented this increase in use of private automobiles to transport students to school. (In other areas of Canada, the United States, Britain, Australia, and New Zealand, as well as in countless other countries, this same trend is also documented through anecdotal evidence, and traffic counts conducted by local authorities.)

The GVRD conducts a trip diary survey every ten years in order to understand transportation choices within the region. In 1984 this survey established that one of every three students in the region traveled to school by car. In 1994, the results of the survey indicated that there had been a significant increase in this number, and that almost one of every two students made the school journey in a private automobile. It is estimated that within the GVRD one of every five cars on the road at peak hours is taking a child to or from school or a related activity. The region, which is responsible for air quality, and regional roads, was both surprised, and very concerned about this trend, as it was counter to regional policy objectives. As well, this practice was normalizing driving as the transportation of choice for short, neighbourhood journeys. This trend had the potential to develop a car-dependent attitude in a whole generation of young citizens.

The GVRD Pilot Program

The pilot project that would become the Way to Go ! school program was designed to counter this trend. In the fall of 1997 the GVRD commissioned the design and testing of this school traffic/trip reduction program. Due to traffic safety concerns associated with congestion at school sites the Insurance Corporation of British Columbia (ICBC) provided funding for the pilot project. The researchers were astonished at the huge demand for participation in the pilot phase of the program, arising primarily from traffic safety concerns at schools.

After designing and testing this community development approach to school traffic reduction, the opportunity arose to extend this program to schools throughout the province of British Columbia (B.C.). Due to the successful GVRD Way to Go! pilot, and the growing demand for the program, it was selected as one of the community programs to be sponsored by the RoadSense Team.[1] Way to Go! resources and support are now available to all elementary and middle schools in the province. Since September 1998 Way to Go! has distributed program resources-a manual, resource kit, support and training-in response to requests from over 600 elementary and middle schools in B.C., and in response to over 100 requests from across Canada and from individuals in the United States, England, Scotland, New Zealand and Australia.

Way to Go! School Program Goals

The overall program goal is to change the culture of a school community, so that the identity of a school is strongly and positively associated with making choices to walk, bike and bus safely to school.

The basic approach to enhancing the traffic safety at schools involves the following:

- reduce the number of cars traveling to and from schools by providing positive alternative options;
- emphasize traffic safety education for children and parents.

Way to Go! School Program Design

The Way to Go! School Program was designed to provide individual school communities with the tools to make changes in transportation choices, and to positively work to create options for students to safely walk or bicycle to school. Transportation decisions for elementary and middle school students are primarily made by parents; the program is designed with the school Parent Advisory Committee as the primary audience. The program is flexible, and accessible for a wide range of different kinds of school communities. Schools can use the most useful relevant information and ideas, and adapt the approach to suit their own needs. Most of all the program is designed to be fun, emphasizing the positive aspects of walking and biking to inspire involvement and participation.

Environmental and climate change information and teaching resources, as well as curriculum resources relating to the positive health and fitness impacts of daily moderate activity are also identified in order to elaborate the many important reasons for parents to choose alternative transportation for their child's school journey.

Way to Go! Program Components

The program consists of a Resource Kit: a process manual and related information including resources on traffic safety education, environmental, air quality and climate change issues, as well health and fitness teaching tools. The manual outlines a proposed step-by-step process for a school community to follow in order to introduce safe walking and biking options for students traveling to school.

The Way to Go! program also includes the support of regional coordinators in the Lower Mainland and on South Vancouver Island. These coordinators provide local school district training and hands-on advice and direction for Way to Go! programs.

Bike Smarts is an ICBC RoadSense program that provides guidance for introduction of bicycle safety and riding skills to children aged seven to thirteen. Bicycle safety education is an essential part of Way to Go! program implementation, particularly where schools are focusing on bicycle options for student travel. Schools are encouraged to register with the Bike Smarts Program, and extend this curriculum resource to the students within the school.

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[1] The RoadSense Team was formed as a result of a partnership between ICBC and the Autoplan Brokers of B.C., to provide five year community based traffic safety programs across the Province. Because of the successful GVRD Way to Go! pilot, and the growing demand for the program, it was selected as one of the provincially sponsored programs.

Way to Go! Implementation

The Way to Go! program is designed to assist elementary school Parent Advisory Committees by:

- providing ideas, tools and resources which can be used to implement car use reduction strategies;
- providing tools to develop more traffic safety awareness at school sites;
- introducing strategies and opportunities for children to have the option to walk, bike or bus to school safely.

Data Gathering: Surveys

To begin the process of organizing a Way to Go! traffic reduction program, schools conduct student and parent surveys to determine current travel choices, and any challenges and opportunities for their school's program. These surveys also help gauge parent support and identify volunteers interested in working to organize the program.

Data Gathering: Mapping

Students and parents map the school areas, and conduct traffic and pedestrian counts. These exercises provide a better understanding of the traffic issues at the school, and allow an opportunity to identify sites where there are a large number of conflicts between vehicles and child pedestrians. It is also an opportunity to identify the best routes to school for child pedestrians or cyclists by ensuring that these proposed routes are as safe as possible.

Planning for Walking and Biking Strategies

After analyzing school survey and mapping data, project teams plan walking, and, where feasible, biking strategies best suited to their individual community needs.

Promotion & Communication

Promotion of the program occurs in a variety of ways, but the strongest champions of the program have usually been committed due to the traffic safety improvements that can result. It is useful to note that the multiple benefits of the program, which include the traffic safety, health and fitness, environmental and community building benefits, combine to provide a strong motivating influence on schools, inspiring them to create change.

Formal recruitment of school districts did not begin until January of 1999; due to media coverage across B.C. in the fall of 1998, many schools became interested and involved in the program. In some municipalities and school districts traffic safety officers have taken the lead in distributing program brochures, and encouraging schools to request the Way to Go! kits. In other areas, the municipality has had a key role in taking the program materials to elementary and middle schools. Way to Go! provincial and regional coordinators have made presentations to a variety of groups including District Parent Advisory Committees, school boards, school district principals' and vice-principals' meetings, school district traffic safety committees, individual Parent Advisory Committees, municipal councils, community policing conferences, injury prevention conferences and alternative transportation conferences.

The formal communication strategy involves sending program information twice each school year, to all relevant schools in the fifty-nine provincial school districts in order to introduce the program to the Superintendents of Schools, the School Boards, the District Parent Associations and the Parent Advisory Committees in each of these areas. When enough interest is indicated, a training meeting is planned in order to provide further support and advice for school project teams in specific school districts. The Way to Go! website is also a resource that schools can access; as the program develops, there is a better understanding of how to use this communication medium to support schools involved in the program.

At schools where the community has been able to integrate signage that identifies the school with the Way to Go! program, a very strong and positive identity with the program has developed.

Building on the Experience

Schools have experienced reduced number of cars at school sites and more children are walking and bicycling. The pilot schools that began the program in December of 1997 are still involved Way to Go! Schools. In Delta, B.C. one of the pilot schools, Hawthorne Elementary, has documented a significant decrease in the number of cars arriving at their site: before the program well over 50% of children travelled to school by car; the numbers of children walking and cycling is now over 75% of the school population. The value of the program in a variety of communities, is indicated by the cross section of people involved, and integrated in the process: police, school districts, municipalities, engineers, planners, parents, teachers, and administrators all endorse and participate in supporting the program.

A number of the pilot schools have been incorporating the Way to Go! program into their school planning for almost three years. These schools have continued to increase interest and involvement in the walking and biking strategies; they have also taken on a leadership role in their school districts and inspired other school communities to become involved, and participate in the program. One of the most positive aspects of the program is the sense of community that schools develop as they work toward the common goal of making it safer for their students to have the option to walk or bike to school.

Understanding the aspects of organization or the approach that leads to sustaining a program in a school is essential to establishing how to build on the initial commitment, and create an ongoing, enduring change in travel behaviours.

Recently there have been a number of opportunities established for parents, and other stakeholders, to review and assess the Way to Go! program, and make recommendations to improve the resources and support. A focus group, as well as telephone and e-mail surveys have been conducted. During this process, a few individuals were chosen to respond to questions with regard to the value of the program in their community, and the impact of the program on their understanding of the environmental, climate change, and air quality concerns associated with travel choices that rely solely on depending on a car.

Each of these parents is involved with schools that have taken a leadership role with their Way to Go! Program. These schools have been recognized in a variety of ways for their work on this initiative, and the program has become a strong component of the school community identity.

The individual parents involved with responding to these questions represent the following schools:

1) Braemar Elementary, North Vancouver.
2) Jules Quesnel Elementary, Vancouver.
3) Hawthorne Elementary, Delta

(See Appendix 1 for more information on each school).

Although the three schools are notable because of their tremendous Way to Go! program organization, they are not entirely unique: **there are currently as many as 200 to 250 schools actively involved in promoting safe alternative transportation to schools in B.C. using the Way to Go! program resources.**

Focus Group Responses

The parents involved in this mini-focus group have explored different ways to both introduce and sustain the program in their own school communities. They have also acted to positively influence and support the involvement of other schools in their neighbourhoods, and/or school districts.

The following statements emerged from the focus group:

- Provision of the Way to Go! program materials and support were essential to parents' decision to promote alternative transportation at their school. Without the program these volunteers would not have been able to take on such a large undertaking. The outlined process, and the existence of the program made it seem possible for them to be effective in reducing school traffic.

- Although traffic safety concerns were the primary motivation for these schools to become involved with Way to Go!, the related educational information extended their understanding of the whole issue of car use, and the problems associated with car dependence. Connections to and understanding of the health and fitness benefits of walking and biking as a daily activity, as well as extending their understanding of the important environmental (air quality and climate change) reasons for choosing to walk or bike to school and other local destinations has increased their commitment to continuing the program.
- Student involvement has been a strong component of the programs at these schools. This has been very positive and has built and developed a strong identity and association with the environmental benefits of choosing to drive less. Within these schools there has emerged a strong identification with alternative travel choice; this is an identity that students are very proud of. When students learn more about climate change and environmental issues, they understand that they can make a difference, and they realize that individuals and communities do have the power to make positive transportation choices.
- This program has affected parents' driving habits, they do drive more safely, and they drive less. As they consider more carefully their choice to travel by car to a particular destination, their consideration often results in a walk or bike journey, as the necessity of driving short distances has been discounted.

CONCLUSION

The severity of the impacts of cars on children is extensive and solutions are needed now. Parents in Canada and elsewhere have demonstrated that they can be motivated to change their behaviour through concerns for their children.

Parents who are sensitized to links between transportation and their children's health and social development needs are likely to embrace other solutions, including legislation. General climate change awareness campaigns may also be more effective once parents and children have become actively engaged in reducing car usage.

The Way To Go! program, which creates change at both the individual level and community level, may prove to be more efficient than conventional public education and awareness campaigns. The delivery of these programs also provides additional benefits for children's health and well-being. Programs such as this may lay the foundation for building a sense of community in which a culture for sustainability will flourish.

Parents have stressed that formal programs are needed to give direction to school trip reduction programs. All levels of government have an opportunity to support similar programs across Canada. Specifically, school car trip reduction programs should be included in Transportation Climate Change strategies regarding passenger travel, public education and awareness. ❑

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APPENDIX 1

Braemar Elementary, North Vancouver
Braemar is completing their first complete year of involvement with the program. Braemar has played a key role in challenging and inspiring other schools in the North Vancouver School District to become involved in promoting walking and biking to school. Braemar parents coordinated the Way to Go! program with the Parents for Science organization, and have worked on a variety of positive projects including a planting a community garden, and establishing a school recycling initiative. Braemar received the Vancity Savings Credit Union Environmental Education award because of their combination of efforts to support student learning about how they can work towards positive change in their communities.

Jules Quesnel Elementary, Vancouver
Jules Quesnel is completing their second full year of involvement with Way to Go!. Although the catchment area for Jules Quesnel is more extended than a usual neighbourhood school, (as this schools is a district French Immersion school), students in this community regularly walk and bike to school, often travelling a considerable distance. As well as promoting safe walking, Jules Quesnel has organized their second successful Bike Week this April, in order to provide an incentive for parents and children to prepare their bicycles for a season of riding to school. This week includes bike challenges, bicycle safety education, a bike rodeo and a bicycle race (the Tour de Jules Quesnel). This variety of activities explores the recreational, competitive sport and transportation relevance of the bicycle for students. Last year on Clean Air Day 1999, the Mayor of Vancouver recognized Jules Quesnel, and other Vancouver schools for their contribution to alternative transportation initiatives within the municipality.

Hawthorne Elementary, Delta
Hawthorne Elementary was a school involved in the original Way to Go! pilot project. For almost three years, Hawthorne has continued to champion the program in their school district. In the spring and the fall, there are regularly over a hundred students bicycling to this school; 550 students attend Hawthorne Elementary. This school continues to host fabulous event days. It has learned, from experience, that maintaining enthusiasm in the program relies on understanding that you need to develop events and celebrations that reinforce the message that it is important to make the choice to walk and bike to school, and to avoid driving unless it is completely necessary.

Greenhouse Gas Reduction in Canadian Schools

Eric Foster

Although climate change is a worldwide phenomenon, Canadians must address and take personal responsibility for their own substantial contributions to the problem. And as it is with most change initiatives, education is a critical component. While engaging schools and higher education is very difficult, the rewards are high. It is the students of today who will inherit the world of tomorrow. If they are taught to embrace and practice environmental citizenship, the accumulative effect will be very impressive. Schools with Climate Change programs and greenhouse gas reduction strategies, will not only provide a relevant curriculum but will produce savings that will result in decreased emissions and reduced utility costs.

INTRODUCTION

Global Warming is not like turning on a heater. We can't just turn it off if the Earth warms too fast for comfort. Once we emit greenhouse gases into the atmosphere, most of them remain there for decades, continuing to trap heat. If we wait until all the consequences become obvious, it will be too late to do much about them. But we can act now to insure against the risk of disruptive climate changes by reducing our greenhouse gas emissions today. And one of the ways to do this, is to become more energy efficient.

What can be done at the school community level to reduce greenhouse gas emissions?

Schools must improve their environmental citizenship. This involves school inhabitants voluntarily taking responsible environmental action. It is important that all Canadians, young and old, rise to the challenge of reducing greenhouse gas emissions. Effective short-term solutions that don't endanger our future are necessary right now.

To begin, educators must take the responsibility for ensuring that Climate Change information is part if the curriculum. This is vital because it will increase understanding of this complex issue and prepare everyone to become part of the solution. It is this knowledge which acts as a catalyst and establishes the "need for action". Our climate is changing and we are all going to have to work together if we are going to successfully address this problem.

And finally, teachers and students must work together by looking for opportunities to lower emissions of greenhouse gases, especially CO_2. The environmentally responsible choices we make within our schools can have considerable impact on the emissions that are produced.

Where do we start?

According to Louise Comeau, former Director of Energy and Atmosphere programs at the **Sierra Club** of Canada in Ottawa, "the **Destination Conservation** program is an ideal way for students to actively get involved in reducing their school's emissions".

What is Destination Conservation?

Destination Conservation (DC) is a multi-year environmental program for schools designed to reduce energy use, increase water conservation, implement waste management programs and reduce greenhouse gases. The program also enhances curriculum, modifies behaviour, and is self financing through utility savings and waste reduction.

The DC program effects savings in terms of reduced utility bills and acts as an agent to change behaviour and conserve resources among all members of the school community. To further increase resource efficiency gains, the school district can use the money saved by the project for long-term "retrofitting" of its school buildings.

Destination Conservation also establishes a broad community base as it involves students and staff in environmental awareness campaigns, teaches students leadership skills and responsible resource stewardship, and leaves a legacy for other community organizations to emulate.

Destination Conservation (DC), which is hailed as the finest curriculum of its kind
- addresses many aspects of the Curriculum
- delivers utility savings of 5 to 10 %. (the average elementary school saves $2500 to $3000 per year and the average secondary school saves substantially more)
- reduces greenhouse gases by up to 20%
- cuts waste production by up to 50%

Within the context of the DC program, students also learn to adopt the conservation ethic and to take leadership in transferring this learning to their homes and communities. In addition, students have the opportunity of being connected to DC WATCH, a program that measures and monitors the CO_2 reduction contributions of the educational community.

This educational resource conservation program is currently in place in a number of school boards in Ontario (Toronto, Ottawa, Hamilton, Hastings, to name a few) and in dozens of school boards across the country.

To date, **Destination Conservation** has been implemented in more than 2000 schools across Canada, producing cumulative savings of more than $ 3 million. The program has also prevented the emission of approximately 120 tonnes of carbon dioxide/school/year into the atmosphere.

Most important however, the program is having a lasting effect on students and teachers as they become more involved with helping to renew and sustain our environment.

How is Destination Conservation Implemented?

DC is implemented through three interactive half-day in-service workshops which are delivered in the first year of the program. During these sessions, participants engage in an experience-based learning process, which focuses on specific learning outcomes. The goal of the program is to permanently integrate DC into the school Board's structure. Each in-service is therefore designed to develop self-sufficiency.
- **In-service #1** introduces principals, teachers and custodians to the DC program and outlines their role in the process. Representatives from each school are provided with an overview, are introduced to the DC manuals, and are guided through a team-building process. Stakeholders are asked to identify potential obstacles to the implementation of Destination Conservation, and to provide potential solutions. The teams return to their schools with an action plan to form a conservation club or class. Traditionally implemented in October, the program can and has been implemented in January or February.
- **In-service #2** shows teachers and students how to conduct lifestyle campaigns. Campaigning enables students to communicate a conservation message to the entire school and to facilitate a process for changing school conservation behaviour. Participants are taught how to read hydro meters, water meters, gas meters, utility bills, and Fast Accounting Systems Energy Reporting (FASER) performance reports. The teams then return to their schools to implement their campaigns. Following the campaigns, the school teams, the plant operations personnel, and the DES Destination Conservation team use utility bills and FASER performance reports to monitor and

record energy and water consumption, and waste production, relative to baseline figures.

- **In-service #3** is the annual year-end celebration for teachers, custodians and students, and is hosted by the Destination Conservation team. At this event schools, teachers, and administrators who have done outstanding work throughout the school year are recognized. Schools also take part in environmental education workshops as well as make their own presentations based on their success experiences. To be implemented in April or May.

Years two and three also consist of student and staff workshops and celebrations designed to further increase the knowledge and commitment required to reduce resource consumption and move society towards a sustainable future.

In addition to the in-services for teachers and students, DC offers a comprehensive Building Operators Training Program which introduced school custodians to energy conservation principles and technologies

There are three manuals for the DC program: a School Conservation Team Manual, a Program Manual, and a Teacher's Resource Manual.

By implementing the **Destination Conservation** program, a board of education lowers greenhouse gas emissions, improves environmental awareness, increases utility and waste savings and deals with a portion of the mandated Ontario Science and Technology curriculum. In addition, it benefits by being seen as taking a leadership role in environmental education and environmental stewardship, which will undoubtedly have a positive impact on board image, staff morale and student academic performance. ❑

Youth in Media – Engaging Youth in Change

Peter Campbell and Kathryn Molloy[1]

Youth between the ages of 12 and 24 are currently the most powerful consumer-spending group in North America. Most major corporations recognize that the use of television is the most effective way of reaching this audience and changing their consumer choices. The Youth in Media project gives young people a strong voice to engage other youth with messages that motivate them to take practical action to reduce greenhouse gas emissions.

Youth in Media develops programs and raises funds to provide young people with the techniques and the technology to tell their own stories. Youth in Media is a collaboration of Gumboot Productions Inc. and Molloy & Associates Consulting of Victoria, BC.

BACKGROUND

Gumboot Productions Inc. is a Canadian film and television production company owned and operated by the founding principals, Penelope Joy and Peter C. Campbell. The main focus of the Company's activities is on entertaining works of cross-cultural, environmental and educational content. Gumboot Productions produces film and video in association with artists, institutions and broadcasters and actively participates in partnerships and joint ventures. Gumboot licenses programming to Television Broadcasters and Distributors internationally.

Molloy & Associates is a project management firm in Victoria, Canada that offers a diverse team of professionals that promises thorough, thoughtful and co-operative services in the full management of a project. Services include fundraising, project planning, time management, cost and quality management, communications, financials and stakeholder relations. They have worked with all levels of government and the private and non-profit sectors to provide opportunities that engage people emotionally and intellectually in issues of health, environment, the arts and community.

The Access to Media Education Society (AMES) is a registered non-profit organisation dedicated to providing broad-based access to media training, producing community-based media programming and promoting media literacy & ethically responsible image production. Web Site: www.gulfislands.com/ames/.

The Gulf Island Film and Television School (GIFTS) is an innovative live/work media centre located on Galiano Island, in the Southern Gulf Islands of British Columbia. It is a full service film school offering on site training in acting, directing, camera operation, lighting, sound and editing for drama documentary,

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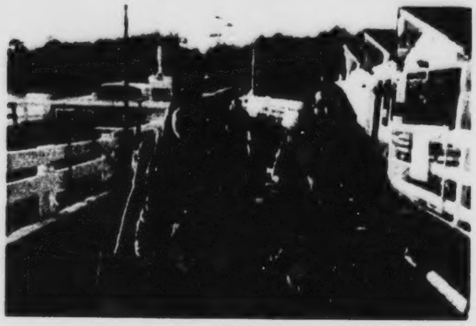
[1] Contributing Author – Willox, Jordan, Participant



classical and computer animation films. Full accommodation and catering are provided. Over the past years, hundreds of students have expanded their career options and enjoyed improved marketable media skills from attending GIFTS. Web Site: http//www.youthfilms.com

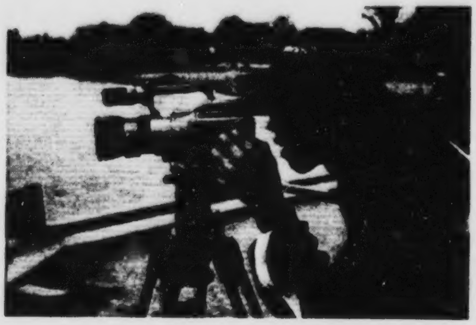
To date, the program has brought together more than 30 youth between the ages of 16 and 24 to produce thought provoking television broadcast Public Service Announcements (PSA's) on climate change issues. These PSA's have been broadcast throughout Canada on CBC National Television starting in January 1, 2000. It has been a unique and highly empowering project that has helped youth learn about climate change issues and develop their job skills by learning from beginning to end the process of television production. The end product has been a series of engaging and relevant PSA's that communicate strong and urgent messages to the Canadian public on environmental issues. This presentation explores the use of television media as a social marketing tool for raising awareness of climate change issues. A dynamic talk on tools and methods for empowering youth to make changes in their lives and influencing the lives of their peers. The presentation includes slides, PowerPoint and a viewing of the PSA's produced to date.

PROJECTS

Youth in Media – Action on Climate Change

In September, 1999 independent film producer Peter Campbell (Gumboot Productions Inc.) and management consultant Kathryn Molloy (Molloy & Associates), met 20 youth at the Gulf Islands Film and Television School (GIFTS) to create Youth in Media's "Action on Climate Change". This pilot project, co-ordinated by The Access to Media Education Society (AMES) brought together British Columbia Youth between the ages of 16 and 24 for 10 days on Galiano Island, British Columbia.

The goal was to produce Public Service Announcements (PSA's) dealing with issues relating to climate change, as well as to empower youth by providing them with a voice and medium of communication. The intent was to produce works of a high standard – both technically and artistically – in the hopes of getting the messages broadcast on television.



After arriving on Galiano Island, the group went sailing off Retreat Cove where Paul LeBlond (University of British Columbia Professor Oceanography) discussed the effect of climate change on the ocean ecology. This was followed by a hike to Pebble Beach and a discussion about the Pebble Beach Climate Change Monitoring Project.

Over the next few days, the students were given workshops on social marketing and climate change issues. They developed scripts for the production of the public service announcements. This was followed by workshops on visual storytelling, acting, computer animation, classical animation, cinematography, lighting, sound, production design, directing and non-linear digital editing.

Four participants produced computer animation, four more produced classical animation, and the remainder began production on dramatic and documentary messages. Some of these productions were filmed in Vancouver, with the remainder on Galiano. Then came the editing, sound effects, music and titles, sleepless nights, computer crashes, then countdown to the world premier screening! It was ShowTime on Galinao Island and screening room was packed.

A total of 16 PSAs were produced and 9 of these are currently being broadcast throughout Canada. Three of the PSAs have won awards in provincial and international festivals. The Frog, a classical animation film, is the recipient of a silver award from the Summit Awards in Portland winning the votes of judges like Saatchi & Saatchi, Ogilvie & Mather and The Marketing Deli. The video productions "Gas Face" and "Grandfather" won Outstanding Achievement Awards in the 5th Annual Eyelens Festival in British Columbia. Grandfather has also won Best PSA/Promo Video in the post secondary category at the Cascadia Festival of Moving Images in May, 2000

Youth in media – Clean Air Day

Youth in media was contacted by representatives of the British Columbia Ministry of the Environment on behalf of Clean Air Day organisers. The organisers wanted to facilitate the production of two new public service announcements (PSA's) for television on the subjects of National Clean Air Day and The Commuter Challenge.

In early 2000, six students from Victoria High School jammed ideas and came up with the concept of a forest going on strike ("Solidarity") and a woman's love affair with her car ("Obsession"). The students made a "we need" list: talking trees; a machine that dispensed clean air; 25 movie extras (supplying their own wardrobe): final scripts and shot lists, cameras, lights, digital editing machines…

A week later the cameras rolled, the rain held back, the extra's showed up and the art department recreated a soft drink dispenser into an awesome clean air machine. Even the trees talked (with a little help from some fishing line). After 10 hours, two thirty second public service announcements slated for national television were "in the can".

Now things got trickier: how to cut forty minutes of material into a total of one minute? And with seven people in the editing room. Decisions, compromises, insights and "lets try it this way – no, how about this way?" Will the client like it? And how about all those extras we asked to show up early Saturday morning that have now been cut out of the film??

Editing the material down to two minutes was easy, but after that, every second edited out was like a major victory. On the second day of editing, music and titles were added, a master copy was made and then it was off to the broadcasters.

Clean Air Day commercials aired on national television for two and a half weeks before the National Clean Air Day celebrations on June 7, 2000. Another success for Youth in Media!

Youth in Media has been primarily funded by Environment Canada's Climate Change Action Fund

GOALS

The Goal of this project is to help Canada meet it's commitments to the environment by creating broadcast Public Service Announcements and a corresponding Web Site that demonstrates how the federal government is:

- working with partners to meet our country's international commitment to address climate change by reducing greenhouse gases
- protecting species at risk and their critical natural habitat to extend Canada's national parks system
- cleaning up contaminated sites on federal lands and supporting innovative clean-up technologies

- placing greater emphasis on sustainable development in government decision making and using the PSA's as a method of reporting regularly to Canadians on progress in addressing environmental concerns

BENEFITS

- Empowering youth to work in a powerful social marketing medium for a national television audience
- Giving youth a voice on an important global issue
- Offering coast to coast to coast broadcast of effectively produced PSA's to raise public awareness so Canadians might understand and address climate change issues

Preparing youth for employment opportunities in the growing field of environmental communications, offering them skill-building opportunities in script writing, filmmaking, web design and project management

QUOTES FROM PARTICIPANTS

"I'd like to grab a lot of people in my life and give them this experience. It has given me a new confidence in the human race" Michael Halverston, 24 years

"Youth in Media gave me the opportunity to speak my mind on very important environmental issues. Not only was my opinion respected but Youth in Media provided the medium for my opinion to be utilized. As a young woman this was an invaluable experience". Anita Schoeppe, 19 years

Youth in Media welcomes projects, ideas, co-ventures and creative co-operation. For more information, please visit our website: www.youthinmedia.com

Participant Story by Jordan Willox

As I stepped off the ferry onto Galiano Island a strange feeling hit me. I was here with 20 or so other BC youth that I had never met before. Our mission was to produce television commercials raising awareness about the issues and solutions around Global Climate Change. This magical project took place at the Gulf Islands Film and Television School (GIFTS).

The next ten days were not to be filled with endless quotes and statistics predicting the Armageddon-like demise of the world, nor were they to be spent teaching technologically inept people how to work a computer, or turn on a camera. This was to be a spiritual call-to-arms; an important gathering nestled in the very environment we were trying to save.

I spent two days in total awe of my new comrades. They were of all races and backgrounds, and each brought a unique perspective to the issues at hand. Some were activists; their days spent organising rallies and demonstrations, others, like me, were almost completely unaware of the problems this earth is facing, but regardless, we were all there to send the same message. As we stared blankly at each other that first night, we had no idea of the bond that would be created between us, how much we would learn, or just how loud and clear our messages would be.

The first few days were spent figuring out what we needed to know to do the job. Familiarising ourselves with the issues was a top priority, as was learning the tools of the trade. We became totally aware of what we were doing to this earth and how the simplest of things can make a huge difference. As the time for production neared, it became clear that the greatest challenge we would face was condensing the overwhelming amount of information we had acquired into bite-sized, thirty-second chunks.

It was a daunting task and one that none of us took too lightly. We had been given the chance to voice our opinions, unfiltered, and give a fresh Perspective on issues that have become tired clichés of the 1990s. But, as if troops preparing for battle, an intense feeling of determination and kinship was evident.

Regardless, the battle took its toll. As the days wore on and the nights grew longer, we were still unaware of how much good we were doing. A feeling of accomplishment was anywhere but in the hearts and souls locked away in the editing suites and animation trailers. It wasn't until the screening that any of us had even seen the work of others in a completed or nearly completed form. We were intensely focused on the completion of our own projects that we couldn't have possibly comprehended the impact and potential of what we were doing.

On that screening day, our tiny viewing room was filled beyond capacity and as everyone crowded around a couple of television sets, the significance of our efforts was realised. We had come from all corners of this province, and together we had created something that would be our legacy to the earth and a beacon to others like us a reason to stay motivated and promote change on all levels. After all, we are the new caretakers of this planet, and now is the time to make a difference. ❏

Session F1

INFLUENCE ON PUBLIC UNDERSTANDING OF CLIMATE CHANGE 2

Public Confusion over Climate Change: The Role of the Media
Lydia Dotto
Science Writer

The Mismatch Between the Cultures of Journalism and Science
Ross Gelbspan
Journalist

Public Confusion over Climate Change: The Role of the Media

Lydia Dotto

While the public tell pollsters that they believe "something should be done about climate change", there is reason to question whether they really understand and accept the measures needed to slow or reverse the progress of global warming. They appear to want governments to take action, but many actions that would make sense (e.g. "green" taxes on fossil fuels) would clearly be unpopular. Nor do their personal lifestyle choices and behaviour (e.g. record sales of sport utility vehicles) reflect an appreciation of what individuals can do about global warming. It's not surprising, therefore, that governments are reluctant to act, for it's clear they simply do not believe that people really mean what they tell pollsters.

The debate over global warming has also been badly sidetracked by a preoccupation with inappropriate legalistic definitions of proof, a refusal to deal realistically with scientific uncertainty and a failure to address the question of risk. The existence of scientific uncertainty and controversy confuses many people about the reality and urgency of the climate change problem. Skeptics have succeeded in convincing the public, the media and decision-makers that we must wait for "proof" of the global warming theory before acting — a strategy that has virtually paralyzed policymaking. The overwhelming preoccupation with the question of proof has caused society to ignore the more important question of risk — what do we stand to lose if the projections of global warming come true?

This paper will explore how these factors have affected — in fact, mostly stymied — our efforts to deal with climate change. In particular, it will focus on the role of the media in contributing to public uncertainty, confusion and skepticism about global warming. Economic trends in the media (e.g. the 24-hour news cycle and the growing role of the Internet) make it increasingly difficult for news organizations to deal adequately with the complexity and uncertainties associated with global environmental issues. These trends also force them to put a premium on the economic and the (highly emotive) human-interest aspects of global warming, rather than on the scientific issues. Thus we see intensive coverage of extreme weather events from the human angle (houses crushed by tornadoes, hundreds dying in heat waves, crops destroyed by drought) with relatively little attention paid to the underlying reasons why these events may be happening with increasing frequency and severity.

The media also have difficulty dealing with the complex and often arcane debate between scientists and skeptics over global warming research. Lacking an understanding of and patience for scientific detail, the media frequently fail to examine the evidence with much rigour. Instead, in an often-misguided effort to appear even-handed and objective, they tend to cover such disputes simply as screaming matches between equally armed opponents. It's a model they understand from covering politics and wars, but it doesn't translate well to covering environmental issues. Nor does it do much of a service to the urgent need for greater public understanding of the implications of global climate change.

TRANSCRIPT OF SPEECH

Although many people tell pollsters they believe that something should be done about global warming, there's reason to question whether they really understand even the most basic scientific facts of climate change (for example, many believe ozone depletion causes global warming.) Nor is it clear that they would readily accept the measures needed to slow or reverse the progress of global warming. They say they want governments to take action, but many actions that would make sense (e.g. green taxes on fossil fuels) would probably not be very popular.

Nor do their personal lifestyle choices and behaviour (e.g. buying gas guzzlers like SUVs and vans) reflect an appreciation of what individuals can do to slow global warming. The public may feel a sense of powerlessness to tackle a global problem of such magnitude, thinking that it's up to governments and industry to find solutions.

It's not surprising, therefore, that governments are reluctant to act to cut greenhouse gas emissions, for it's clear they're doubtful about the depth of public understanding of the climate change issue and they simply do not believe that people really mean what they tell pollsters about their willingness to fight global warming. The emphasis on public education initiatives as part of government global warming policies is evidence of this.

One major reason for the lack of public understanding and commitment is the continuing effort by global warming skeptics to dispute the reality of global warming and its negative impacts. Unfortunately, this debate has been badly sidetracked by a preoccupation with inappropriate legalistic definitions of proof, a refusal to deal realistically with scientific uncertainty and a failure to address the question of risk.

Skeptics have succeeded in convincing the public, the media and decision-makers that we must wait for "proof" of global warming before acting — a strategy that has virtually paralyzed policymaking. They appear to demand a standard of proof analogous to that used in criminal trials—beyond a reasonable doubt—and have thrust upon the scientific community the burden of proving the global warming "case" to this high legal standard. In fact, some skeptics dismiss any scientific findings that support the global warming hypothesis as "junk science", leaving the impression that there is simply no evidence they would accept as proof.

It is unreasonable to argue that we should wait for proof of this sort, since it means we must wait for climatic disaster. Instead, the standard should be that of the civil trial—a *preponderance of evidence*. Scientific research has provided us with compelling evidence for the reality of global warming and grounds for serious concern about its potential for causing harm. The fact that we don't know everything does not mean we don't know anything. We may not have absolute proof, but there comes a time when we can see the direction in which the weight of accumulating evidence is tipping the scales. What we should be concerned with is whether the projected impacts of global warming are *more likely to occur than not.*

Scientific uncertainty is one of the most misunderstood aspects of this debate. Many non-scientists do not realize that when scientists talk about "uncertainty", they are typically referring to findings in which they have a level of confidence below about 90 to 99 percent. In short, they classify things as "uncertain" at a much higher level than most of us in do in our daily lives.

Disputes among scientists are usually over uncertainties at this extreme end of the scale but the public often concludes that scientists cannot agree on anything. Worse, they assume that if scientists cannot agree on the problem, the problem must not be that bad—or that it must not exist at all. They often fail to realize that uncertainty goes in both directions—that it is just as likely that the situation will be *worse* than scientists project as that it will be better.

We make decisions every day with levels of uncertainty greater than those used in scientific debate. If we insisted on a 90 to 99% probability for everything we do, most of what we call daily life would grind to a halt. Nevertheless, many people still expect that we should wait for scientists to tell us definitively what's happening to the climate before we do anything about it. This is the attitude that skeptics successfully exploit when they exhort us to "wait for proof."

Scientific uncertainty and controversy have provided an effective mechanism for diverting the scientific community—and everyone else—into unproductive wrangling over what is, ultimately, the wrong question. It diverts attention from the real issue, which is *not* whether global warming projections will come true but whether humanity will be prepared to deal with the consequences if they do. The overwhelming preoccupation with the question of proof has caused society to ignore the more important question of risk – i.e. what do we stand to lose if the projected effects of global warming actually occur? This is the question we've barely begun to answer because, thanks largely to fruitless debates over the issue of proof, we've barely begun to ask it.

Because, for most people, the mass media are the primary source of science information, the media have played a significant role in perpetuating this unproductive "waiting for proof" debate. Economic trends in the media (e.g. the 24-hour news cycle and the growing role of the Internet) make it increasingly difficult for news organizations to deal adequately with the complexity and uncertainties associated with global environmental issues. These trends also force them to put a premium on highly emotive human-interest aspects of the global warming story, rather than on scientific issues. Thus we see intensive coverage of the human impacts of extreme weather events (houses smashed by tornadoes and hurricanes or washed away by floods, hundreds dying in heat waves, crops destroyed by drought etc.) but relatively little attention is paid to the underlying reasons why these events may be happening.

The media also have difficulty dealing with the complex and often arcane debate between scientists and skeptics over global warming research. Lacking an understanding of and patience for scientific detail, the media frequently fail to examine the evidence with much rigour. Instead, in an often-misguided effort to appear even-handed and objective, they tend to cover such disputes simply as screaming matches between equally armed opponents. It's a model they understand from covering politics and wars, but it doesn't translate well to covering environmental issues. Nor does it do much of a service to the need for greater public understanding of the implications of global climate change.

There is an urgent need to reframe the climate change debate, shifting from the question of proof to the question of risk. Risk involves two components: the *probability* that something will happen and the *consequences* if it does. Our problem is that we've been so preoccupied with the first that we've neglected the second.

The concept of protecting against risk is not difficult for the average person to grasp; in our own lives, it is called insurance. We buy insurance despite the uncertainties that the disasters they protect us against will ever happen. We do not expect proof that our house is going to burn down in order to buy insurance; we do it because we don't want to face a catastrophic loss if it does. It's precisely because the consequences are potentially devastating that we protect ourselves against them even if we believe their probability of happening is very low.

There is no proof that global warming will cause catastrophic damages around the world. The proof would be the disaster. But the probability that it will do so is high—certainly at least as high as many of the risks we routinely protect ourselves against every day. We must stop deluding ourselves about the nature of the decision that confronts us at this time. We may think we still have time to make a decision but the longer we wait, the more limited and expensive the options left to us and the harder they will be to accept. The argument that we are just "waiting for proof" of global warming is a comforting fiction we use to avoid facing these hard choices. It is a cleverly misleading way of presenting an option that does not involve "waiting" at all. It is, in reality, an affirmative decision to allow our experiment on the earth's climate to proceed unchecked.

We must recognize the strategy of "waiting for proof" for what it is: a form of gambling. We are betting that projections about the negative impacts of global warming will not come true. If we are intent on playing this game of chance, however, it is important that we ask ourselves: What are the stakes? What do we risk by continuing to play? What do we stand to lose if the worst does come true?

Finally, and most importantly, are we so wedded to the choices that have forced us into this game that we cannot bring ourselves to even think about the stakes or to question the risks? Are we like addicted gamblers who can not walk away no matter what it costs to stay in the game?

Unless we start re-thinking this issue, there is no hope for a solution to global warming. Political leaders are failing to act precisely because they don't believe the public really understands the problem or the risks involved, or that they're truly willing to make the behavioural changes needed. It will require far more aggressive signals from all of us to get them moving. ❑

This lecture is based in part on "Storm Warning: Gambling with the Climate of our Planet", by Lydia Dotto.

The Mismatch Between the Cultures of Journalism and Science

Ross Gelbspan

Drawing on thirty years of experience in journalism, this presentation will provide insight into the journalist's perspective on climate change. Special consideration will be given to the way the U.S. media has covered (or not covered) the issue, with an emphasis on the economic and political aspects of climate change, and the critical issues of journalism ethics as they relate to the coverage of the climate crisis. In addition, the very effective campaign of deception and misinformation by the fossil fuel lobby in the U.S. will be highlighted.

This presentation will provide an opportunity to address the link between inadequate media coverage and the lack of a political constituency in the U.S. around the climate issue. Moreover, it will address the "communications mismatch" between the culture of science and the culture of journalism, and provide suggestions that would aid scientists in better communicating various aspects of climate change to the press and public without violating the integrity of their science.

TRANSCRIPT OF SPEECH

I'm a reporter — not an environmentalist — so I came to this subject from a very peculiar angle. After I retired from The Boston Globe and was working on my second consecutive unpublished novel, there came to me Dr. Paul Epstein, with a series of articles he had published in The Lancet on climate change and the spread of infectious disease.

Since the work struck me as important, I collaborated with Dr. Epstein on a piece for the Outlook section of The Washington Post. While writing the piece, I became very alarmed about the larger issue of climate change and began to consider writing a book on the subject.

But after the piece ran in the Post, I received several letters from readers who said that, the disease information notwithstanding, they didn't believe the climate was changing and they referred me to the work of a few scientists. So I read Bob Balling's book, The Heated Debate, several issues of Pat Michaels' journal and a paper by Richard Lindzen. And I was persuaded that global warming was a non-issue. I told my wife there's no book here. And emotionally, I was very relieved not to have to deal with such a heavy issue. But I had scheduled interviews with four other scientists, and, just as a courtesy, I decided to keep those interviews.

Those scientists completely turned my head around. They showed me how the Michaels and the others were manipulating data and misrepresenting the situation. That made me quite angry. Not because I love trees — but because I had spent 31 years in a career predicated on the belief that in a democracy we need honest information on which to base our decisions. What these few scientists were doing was stealing our reality.
I also heard murmurs about their funding — and subsequently learned some "skeptics" were receiving large amounts of undisclosed payments from coal and oil interests. At that point, I thought if there's such a large cover-up, let's see what it is they're covering up. And that's when I began to learn the science and many other aspects of the climate issue.

Seen from a global perspective, climate change is, I believe, the most profound challenge ever facing humanity.

While governments try to ratify emissions reductions of six to seven percent, a larger reality is being ignored. The science tells us clearly we must cut our emissions by 60 to 70 percent if we are to stabilize the global climate.

As one top IPCC scientist told me: "If this newly unstable climate had begun 150 years ago, the planet would likely never have been able to support its current population of 6 billion people."

This, for me, is the central drama underlying the issue: the ability of this planet to sustain civilization versus the survival of the largest commercial enterprise in human history. The oil and coal industries together generate nearly two trillion dollars a year in revenues. They support the economies of more than a dozen countries in the Middle East, Latin America, Africa and elsewhere. In the battle against their inevitable transformation or demise, their resources are virtually without limit.

Which leads me to the first barrier to public understanding of the climate crisis. Over the last decade, the fossil fuel lobby has mounted a extremely effective campaign of disinformation to persuade the public and policy-makers that the issue of atmospheric warming is still stuck in the limbo of uncertainty. That campaign for the longest time targeted the science. It then misrepresented the economics. And most recently it attacked the diplomatic foundations of the climate convention. And it has been extraordinarily successful in creating a relentless drumbeat of doubt in the public mind.

In 1991, Western Fuels, a $400-million coal consortium, declared in its annual report it was launching a direct attack on mainstream science and enlisting several scientists who are skeptical about climate change — specifically Drs. Robert Balling, Pat Michaels and S. Fred Singer.

These self-proclaimed "greenhouse skeptics" would normally not be worthy of much attention. There are only about a dozen visible ones versus a consensus of more than 2,000 scientists from 100 countries reporting to the UN. But, with extraordinary access to the media thanks to their corporate sponsors, these "skeptics" have been able to keep the public completely confused about the issue.

Eight years ago, Western Fuels and several coal utilities launched a half-million-dollar public relations campaign which called for local press, radio and TV appearances by Drs. Balling, Michaels and Singer. According to its strategy papers, the purpose of the campaign was to "reposition global warming as theory rather than fact." The same document indicates the campaign was designed to target "older, less-educated men...[and] young, low-income women" in districts which receive their electricity from coal and, preferably, have a representative on the House Energy Committee.

Following that fraudulent campaign, Western Fuels spent $250,000 on a propaganda video — which received very extensive exposure — to convince audiences that enhanced carbon dioxide is good for us — that it will benefit humanity by increasing crop yields to help feed an expanding population. Unfortunately, the video overlooks two factors. The first is the bugs. Of all natural systems, one of the most sensitive to even slightest temperature change is insects; even a slight warming will trigger an explosion of crop-destroying, disease-spreading insects. Plant biologists point out an even more unconscionable omission. While enhanced CO2 may temporarily increase yields in the northern latitudes, it will decimate food crop growth in the tropical latitudes where the majority of the world's poorest and hungriest people live. A half-degree increase in the average temperature will cause a big dropoff in the rice yields in Southeast Asia — and a decline of 20 percent of the wheat yields in India — a country where more than 300 million people live in extreme poverty.

A final example lies in the truly evil campaign of character assassination against Dr. Ben Santer when he and Tom Wigley presented their findings on detection and attribution in Washington in May, 1996.

When Santer finished his presentation, the industry people in the audience publicly accused him of unilaterally altering a key chapter in the IPCC report and obliterating references to uncertainty and dissent. When Santer tried to explain that for the sake of clarity he had eliminated a conclusion summary — which duplicated information already in an introductory summary and in the body of the chapter — he was accused of the worst kind of fraud and dishonesty. Watching the attacks that afternoon by S. Fred Singer, Bill O'Keefe of the American Petroleum Institute, and Don Pearlman of the Climate Council was like watching a group of high-school bullies beat up a third-grader in a schoolyard. The same smears, raising questions about Santer's integrity, were echoed in an orchestrated press campaign in the Energy Daily, Pat Michaels journal and even the New York Times.

I will skip other examples, but the point is that this is not ancient history. You need look no further than the March 23 op-e page of the New York Times to see a quarter-page ad by ExxonMobil headlined: "Unsettled Science" which recycles many of the same untruths.

The use of the tiny group of dissenting "skeptics" became clear when they were compelled to disclose under oath how much funding they had received from industry sources — funding they had never before publicly acknowledged.

Michaels, Singer and Balling have received hundreds of thousands of dollars in funding from fossil fuel interests including Western Fuels, British Coal Corp., the German Coal Mining Association, and OPEC. Singer, who has not had an article accepted in the refereed literature for nearly 20 years, continues to be funded by Exxon.

The bottom line on the tiny group of greenhouse skeptics is that without the millions of industry dollars spent to amplify their opinions out of all proportion to their standing in the scientific community, they would be footnotes to the reports of the IPCC.

Unfortunately, their impact has been profound. In 1996, when the chairman of the House Science Committee drastically cut funding for global research programs, he cited statements by the "greenhouse skeptics" and ignored the testimony of four of the world's most accomplished scientists. The chairman of a House subcommittee said the industry-sponsored skeptics persuaded him that funding global warming research amounted to "throwing money down a rathole."

Two polls by Newsweek Magazine underscore the effectiveness of this industry campaign. In 1991, 35 percent of those polled said global warming is a very serious problem. But by 1996, that percentage had dropped to 22 percent.

Partially related to — and partially separate from — the industry campaign, there has been a profound failure of the media in the US in its coverage of the climate issue. Given the dramatic increase of extreme weather events — the floods in Mozambique, the extraordinary December windstorms in northern Europe, the gathering famine in Ethiopia — journalists should include the line: "Scientists associate this pattern of violent weather with global warming." Recently I asked a top editor at CNN why, given the increasing proportion of news budgets dedicated to extreme weather, they did not make this connection. He told me, "We did. Once." It triggered a barrage of complaints by the Global Climate Coalition at the top executives at CNN. They argued that you can't attribute any one event to climate change. That's surely true — just as you can not attribute any one case of lung cancer to smoking. But even though the pattern has been accepted by mainstream science, nevertheless the GCC intimidated CNN into dropping this connection from its coverage.

But there are a couple of deeper journalistic issues here.

For the longest time, the press accorded the same weight to the " skeptics" as it did to mainstream scientists. This was done in the name of journalistic balance. In fact it was journalistic laziness. Real balance would dictate a reporter spend some time reviewing the literature, interviewing a few scientists on background, learning where the weight of scientific opinion lay — and reflecting that balance in his or her reporting. Were that to have happened, the mainstream scientists would get 85 percent of the story — and the skeptics a couple of paragraphs at the end. That, I think, is finally beginning to happen.

(Parenthetically, because I, as a journalist, could challenge the skeptics on their funding but not on their science, I included an appendix of critiques of the work of four skeptics by four leading mainstream scientists. Tom Wigley wrote a critique of Pat Michaels' work especially for the book in which he concluded that not only would Michaels' work not pass peer-review, it wouldn't even accepted for peer-review. Unfortunately, while appendix was useful in scientific community, I don't think one journalist bothered to read it.)

But I think there's a deeper betrayal of trust here by the media. By now most reporters and editors have heard enough from environmentalists to know that global warming could, at least, have potentially catastrophic consequences. Given that reality, I think it is profoundly irresponsible for an editor or reporter to pass along the story with some counterpoising quotes without doing enough digging to satisfy herself or himself as to the bottom line gravity of the situation. Their assessment needn't be the same as mine. But simply to treat the story like any other — without taking the time to reach an informed judgment about its potential gravity — is a fundamental violation of the trust of readers and viewers.

Two years ago, at a conference of the Society of Environmental Journalists, one seasoned reporter from a large newspaper said that he had recently read a scientific paper himself for the first time, rather than relying on the summaries of others. He characterized it as a liberating experience to read the literature first-hand. Most of the other reporters in the room responded as though this were a revelation. So did I — but for the opposite reason. The Bill Stevens' of the world are truly few and far between.

But even if this world were journalistically a better place — and editors and reporters did the kind of work their public expects of them — there would still be the mismatch between the culture of journalism and the culture of science. And nowhere has this been better exploited than by the fossil fuel lobby and the greenhouse skeptics.

You scientists speak in a very conservative language. It is the language of precision, economy and peer-review. This is extremely appropriate within the scientific community but, unfortunately, it can be self-defeating outside your own professional circles.

One example: At Oregon State, I met a graduate scientist named Eric Sanford. When I asked about his research, he explained it involved the influence of temperature on predation rates of sea animals. To my untrained ears, this sounded totally esoteric. It was only more than a year later, when it was published in Science, that I realized his work was an extremely important piece of research.

What Sanford found was that a minimal change in the temperature of shallow surface waters off the Oregon coast could transform ecosystems. Starfish eat mussels. When the water temperature dropped by 5 degrees, the starfish stopped eating the mussels. The mussel population exploded, crowding out barnacles, algae and other organisms and reducing a diverse ecosystem to virtual monoculture. Conversely, when the temperature rose, the starfish ate more mussels than normal, which, in turn, destroyed the habitat for crabs, sea cucumbers and sea worms. It was a remarkable document about the impacts of warming on an ecosystem which completely eluded me because of the way it was initially described.

Let me turn to a different aspect of communication between scientists and journalists.

Two things allowed me write the book as hard as I did. As a journalist, I went beyond computer model runs and data analyses. As a generalist, I could step back and include extreme weather events (even acknowledging their anecdotal character), as well as their economic analogue in the rising disaster relief budgets of governments and the escalating losses to the world's property insurers. I also based my narrative partially on a series warming-driven changes to planetary systems — the warming of ocean surface waters, the warming-driven turnover of marine populations in Monterey Bay and the butterfly migrations from Mexico to Canada, the warming of the deep oceans — with the attendant break-up of Antarctic ice-shelves and the change in El Nino patterns, the melting of the glaciers, thawing of the Tundra, the expanding range of infectious disease, changes in the timing of the seasons, demonstrable sea level rise, and, of course, the rise in carbon concentrations to levels unseen in 400,000 years. So as a generalist, I had the advantage of being able to incorporate all these various bodies of evidence.

There is a reason the skeptics have focused almost exclusively on the of the climate models. By focusing on the uncertainties of model methodologies — as well as of natural phenomena (ocean-atmosphere interactions, the role of clouds, etc.) and ignoring all the other confirmatory bodies of evidence, they have been able to make a living off uncertainty.

The other thing that permitted me to write the book as hard as I did was because of what the scientists I interviewed said to me off the record. On the record, the scientists I interviewed spoke in very conservative and professionally appropriate language. Off the record, many said things like "This stuff is scary as hell."

Scientists are trained to talk in terms of probabilities and estimates and uncertainties. As a result, they sound to an untrained reporter — and to the public at large — as being vague, wishy-washy, almost indecisive.

By contrast, people like Fred Singer, Pat Michaels and Dick Lindzen speak in sweeping absolutes. At first, there was absolutely no global warming. Then there was absolutely no connection between global warming and extreme weather. Most recently, it has become, yes there is a little global warming — but so little as to be negligible and, in fact, even beneficial.

Without going into the nonsense underlying these assertions, you need to understand that these skeptics sound far more authoritative to reporters and to the public than a scientist who couches his expressions in meticulously accurate terminology.

I think it is critical for scientists to talk to reporters on background in addition to their on-the-record presentations. Explain the work's implications. Put the work in context. Let the reporter know what research gap it fills, what new avenues of inquiry it suggests. There is nothing dishonest about putting part of an interview on background. It is, in fact, a key to communicating effectively — especially with those who do not specialize in science writing.

There is, I think, a similarity between the public and private constraints on journalists and scientists. While journalistic objectivity is mistakenly cited as an ideal, it is non-existent. All journalists have opinions. They support one side of an argument more than another, prefer one person in a story to another. But the craft requires them to put aside these personal responses and create the appearance of objectivity by writing balanced stories which give competing arguments equal power and play. Scientists also have strong opinions about the implications of their work, questions that nag at them in the middle of the night, thoughts they raise about the future. Like journalists, scientists appropriately submerge these personal reflections in the arena of professional discourse. But they should not deny their personal inclinations and opinions. They should use them appropriately — and again I think the format of a "background" or "off-the-record" session provides that opportunity.

It is also important to develop two sets of vocabularies — the one you use with colleagues inside the laboratory, and another for the press and general public.

At the risk of boring you, I'd like to relay how I answer probably the most frequently asked question: How do we know these changes involve human activity and not natural weather cycles. While this is the question the carbon lobby keeps raising, it is also the most frequently asked question by genuinely interested but uninformed audiences. I'd like you to listen to the vocabulary more than the content.

My response goes like this: In 1988, when the world realized the planet was warming, the UN assembled more than 2,000 scientists from 100 countries to answer this very question. In 1995, the IPCC declared it had found the human influence on the climate — primarily from our burning of coal and oil. That finding rested on a number of so-called "signature" studies which distinguished human activity from natural cycles.

Part of that finding was supported by a "pattern study" conducted by a team of researchers led by Dr. Benjamin Santer of the Lawrence Livermore Labs. The researchers mapped the pattern of atmospheric heating — over land and water and warm and cold areas. And that pattern, which conformed to computer projections, was graphically and distinctively different from the pattern of natural warming.

A second "smoking gun" was published in 1995 when a team of scientists at NOAA's National Climatic Data Center verified an increase of extreme weather events in the US. The team was headed by a scientist named Tom Karl who was himself skeptical about global warming. Karl's team examined all the weather records which had been collected since the beginning of instrumentation — enough data to fill 500,000 vintage-1995 PCs. When they looked at weather trends over the previous 20 years, they found altered drought and rainfall patterns, more severe droughts, more heat waves and the fact that we are significantly more of our rain and snow in intense, severe downpours. They concluded that pattern of severe weather is precisely what the computer models project in early-stage global warming and said the forcing of the planet's hydrological cycle by the heating of the atmosphere was due to a 90 percent degree of certainty to "greenhouse" warming.

A third study came from David Thomson, a signals analyst at AT&T Bell Labs, who evaluated a century of temperature data. While some scientists had attributed this century's warming to solar activity, Thomson discovered the opposite: the accumulation of greenhouse gases had overwhelmed the relatively weak effects of solar cycles on the climate. Remarkably, Thomson found that since the beginning of World War II, with its surge of carbon emissions, the timing of the seasons began to shift. And today spring is now arriving more than week earlier in the Northern Hemisphere than it did 20 years ago because of the buildup of atmospheric CO2.

Since the IPCC's 1995 declaration, a succession of new "signature" studies have strengthened the case for human-induced global warming.

In 1997, David Easterling of NCDC found that as the temperature has been rising, the nighttime and wintertime low temperatures have been rising nearly twice as fast as the daytime and summertime high temperatures. That is a specific "fingerprint" of greenhouse warming. If the warming were natural, the highs and lows would more or less rise and fall in parallel.

In April, 1998, researchers examining weather records for the previous 600 years declared that 1997 was the hottest year at least since the 1400s and that the warmest years in that span all took place in the 1990s. While volcanic activity and solar variations had been dominant influences on the climate before 1900, they found those natural forces were swamped by the surge in emissions from coal and oil as the world industrialized.

When those researchers extended their climate reconstruction back to 1000 AD, they found not only that the decade of the 1990s was the hottest in the last millennium — but that the planet had actually undergone a slight but steady cooling from 1000 to about 1880. That trend was abruptly reversed as temperatures began to rise just as the world began its large-scale industrialization based on coal and oil.

In 1999, British researchers examined the planet's temperature record of the 20th Century and looked at four "climate forcing" components — solar strength and stratospheric aerosols (which occur naturally) and greenhouse gases and sulfate aerosols (which are generated by our fossil fuel combustion). The team concluded the temperature changes over the 20th century cannot be explained by any combination of natural forces alone — only by the build-up of human-generated carbon dioxide and sulfate aerosols.

I don't know whether you scientists can live with these kinds of drastically oversimplified narratives. But I strongly suggest you try to develop your own. Pretend you're talking to a class of high school students who are taking the course because it's required. Pretend you're talking to reporters who don't bother to read the literature. It's very important to learn to compress and summarize — without violating the integrity of the work — in ways that make sense to an unschooled audience. It may be a pain and a distraction, but I would suggest it's an integral part of your professional responsibility.

Finally I'd like to talk briefly to the issue of psychological denial. Separate and apart from the disinformation campaign engineered by the industry, there is a very natural human reaction to look away. Confronting an insurmountable problem leaves one with a profound feeling of impotence — which is extremely uncomfortable. And it is a very understandable and human reaction simply to not want to know abut it.

For that reason, I, personally, have been devoting a lot of my own work to explaining the real promise of a global transition to clean energy. Industry portrays that path as a shortcut to global poverty. I think the exact opposite is true. A properly financed energy transition holds the potential for an unprecedented worldwide economic boom. A global public works program to rewire the planet would create millions and millions of jobs all over the world. It would begin to reverse the widening gap between the North and the South. It would allow developing economies to grow without regard to atmospheric limits — and without the budgetary burden of imported oil. And in a very few years, the renewable energy industry would eclipse high technology as the central driving engine of growth of the global economy.

In my public talks, I outline three macro-strategies a group of us has developed to attain a 70 percent reduction in emissions — which includes creation of an annual fund of about $300 billion to transfer clean energy to developing nations. Part of my pitch is that this is not a do-good, liberal, giveaway program. The global climate envelops all of us. This is a critical investment in our own national security. The kind of thinking that is required is the kind of thinking that gave rise to the Marshall Plan after World War II. So that today, instead of a collection of dependent and impoverished allies, we have very robust trading partners with the countries of Europe. And a plan of the scope and scale I outlined would, we believe, have a similar impact on the world's developing economies. It would dramatically expand the equity, stability and overall wealth of the global economy. And I conclude by saying that I believe we have a very short window of time in which we have the opportunity to begin to pacify the climate and to heal the human economic environment as well.

I do believe that if the unvarnished and truly bad news is combined with a message of genuine, honest hope and possibility that is the best antidote to denial one can find. ❑

Session F2

CIVIC ENGAGEMENT 5:
MOTIVATING CHANGE

Marketing Climate Change with Protective Shelter
Paul Camozzi
IGLOO Block

Count Me In! Results of a Research Project to Measure the Impacts of Thirty Workplace-based Workshops to Raise Awareness of Climate Change and Stimulate Personal Action
Maria Kelleher
Enviros-RIS

The Sustainable Living Bus - Motivating Change
Lisa Mitchell
Sierra Club of BC

Using the Climate Change Calculator to Link Lifestyle Choices and Environmental Consequences
Wendy Avis
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Marketing Climate Change with Protective Shelter

Paul Camozzi

"Come in she said I'll give you, shelter from the storm". These famous lyrics from legendary musician Bob Dylan, written some twenty years ago, have an entirely different connotation today, as we market climate change and its implications on "protective shelter".

Environment Canada meteorologists have prepared startling, historical, weather data; most notably the increase in severity and occurrences of our storm systems, particularly intense winds. As one consequence, we are now seeing, to my knowledge, the first time in Canadian History, free pamphlets being distributed to Municipal offices across the countryside, entitled Self Help Advice//Severe Storms.

The University of Waterloo in association with Environment Canada, should be congratulated for hosting a conference such as this, for it allows for timely discussion and debate on how to improve Climate Change communication avenues which can consequently be used to future channel pertinent information. The intent of this paper is, " how are we, as spokespersons for insulated concrete form (ICF) structures, currently communicating the message of the implications of climate change on future safe, protective, shelter, and what marketing suggestions may assist on improving on these techniques".

INTRODUCTION

What is an ICF, or Insulated Concrete Form? Hatched in the early 80s, this method of construction has experienced numerous starts and stops, but now in the last four years due to several factors, including climate change, is now gaining international recognition with close to a 100,000 structures being constructed in the United States last year . ICFS are simply stay in place expanded polystyrene forms, which are then filled with rebar and concrete. Typically recycled plastic or steel ties hold the foam panels apart, accurately position reinforcing bar, and provide a securing method for drywall or exterior finishes. The moisture impermanence of the foam, in most instances, provides an adequate vapor barrier, thus eliminating the need for additional plastic, and provides an excellent exterior substrate for Durock or other related architectural coatings. Once the walls are erected and doors and windows are formed, an alignment/bracing system is attached to the wall via the block's ties, and the wall is now filled with concrete. You now have a wall not only capable of withstanding climatic impacts, but due to its very nature, provides exciting alternatives for mitigating the causes of climate change.

The Oak ridges Laboratory in the United States, has just embarked on a 2 year study to compare the thermal mass performances and strength of a ICF wall system to the traditional wood frame. The primary focus of their study is to determine the energy efficiencies of these wall systems, and subsequent reduction of contributing green house carbon emissions. According to 1995 statistics from Environment Canada,17% of carbon emissions is generated by offices, homes, and institutions. Natural Resources Canada and ATHENA's current studies show that in the first 20 years an ICF 2000 sq.ft. home eliminates some 150 tonnes of CO2 if using oil, compared to a standard wood frame home of the same size. NRCan's Hot 2000 model demonstrates that ICFs offer up to 40% reduction in operating energy requirements over conventional construction. But most importantly these reductions in emissions are achieved by preserving cleansing carbon sinks, our forests.

ICF construction, besides its lightweight nature, has an additional added ozone-protecting benefit. Typically less than 1% waste is generated on an average residential ICF construction site. Conventional wood construction can produce 15-20% waste, which in most cases is landfilled. One tonne of Methane gas is equivalent to 21 tonnes of carbon dioxide. Consequently, ICF building methods and long term energy conservation as a result of those methods, can contribute substantially to the campaign to lower carbon dioxide levels.

As builders and marketers of ICF buildings, we use the subject of climate change daily in our presentations and demonstrations. Our hurricane proof, reinforced concrete walls are promoted Internationally through high level Associations such as the ICF Association and Canadian and American Portland Cement Associations, which currently have very active marketing programs supporting builders of ICF technology. Our wall systems have been tested by the University of Texas for their ability to withstand the impact of gale force projectiles. The Federal Emergency Management Agency (FEMA) recently designated the city of Evansville as the "Model Project Impact Community for 1999". Project Impact is administered by FEMA which encourages communities to improve construction methods to prevent catastrophic losses from natural disasters such as tornadoes and hurricanes. The success of Evansville's program was based on the introduction of "Safe Rooms", which are small windowless buildings constructed out of ICFs.

The State of Florida has currently upgraded their building codes so that structures must be built to withstand 110-mph wind speed, and include a continuous steel tie from roof to foundation. An ideal ICF application.

Although wood frame construction was once common place in the Caribbean, the arrival of hurricanes Andrew, Luis and Marilyn, in the early 90s has forced this method of construction to be changed to concrete block and form work. Again ideal ICF applications.

Consequently as marketers of ICF structures, we have little difficulty in selling this relatively new technology in areas of the United States, and the Caribbean, which have demonstrated historical patterns of severe weather events. The option of a concrete structure over a wood structure does not exist, but rather what type of concrete structure would best suit the application. Our current and future marketing challenge is

" How to communicate the message of climate change to the percentage of the world which historically has not been affected by severe climate patterns, but may very well be in the not too distant future?"

Currently our method of approach is arguably lacking not in its enthusiasm, but in the limited exposure in which the message has to be presented, usually on a one on one basis, or in small group presentations. Improved access to climate change information would educate the consumer and allow them to focus on the remaining benefits of ICF construction, most of which, indirectly affects climate change; lower emissions, reduced land filling, and associated methane production, elimination of clear cutting of forests and consequent improved remediation of carbon dioxide.

From the meteorological data prepared from Environment Canada the largest contributor to severe climate change is excessive winds. Consequently it is not unforeseeable that all future structures will require Engineering approvals to address this terrific wind loading. Again there is a need to educate monitoring bodies on the effects climate change will have on the structural integrity of the buildings they are reviewing. What is becoming increasingly more apparent is that conventional wood products do not have the structural strength to combat the devastating affects of the severe wind loadings precipitated from climate change.

There is most definitely a responsibility to take "the effects of severe climate change on public shelters", nationally. With an international consensus on the fact that our climate is indeed changing, governments should become more pro-active during the support and approval stages of stronger building technologies, rather than reactive to catastrophic events and associated severe economic and human hardship.

As a past environmental consultant the biggest challenge was to try and address and explain the entire environmental cycle of new program initiatives. What are the long term cause and effects of all of the factors involved in the environmental cycles? What trade offs are required to best balance this equation for the greatest returns? Consequently it is important that dialogue on climate change must not just educate the public on the impending dangers of climate change, but also how their purchasing decisions affect or offset the entire contributing cyclical factors of climate change.

HOW TO STIMULATE AND ENCOURAGE DIALOGUE ON CLIMATE CHANGE?

Since climate change is a marketing strategy for our industry, *we* automatically hone in on like media events. The challenge here, in the interest in general safety, is to have the public's radar calibrated to recognize Climate Change articles. The viewer or reader needs to quickly identify, possibly through an international trademark or logo, that what they are about to absorb involves climate change issues.

Our ICF marketing analysis tells us that we are currently attracting the top 5% of consumers. This group is very aggressive in their search for new knowledge on building materials, and consistently uses powerful tools such as the Internet. These are the country's leaders, and additional market research shows that their lead encourages an additional 25%. To stimulate International dialogues on climate change an interactive website with associated business and scientific links is the answer. Properly administered, there is no reason to believe that such a site could not produce revenue to further advance dialogue and possibly fund future studies on climate change.

Radio and Television Spots - Since climate change directly affects public safety there is a need for public service announcements. Simple, catchy, short, bullets of information. What are the effects of a piece of wood hitting a typical home at gale force winds? Corporate sponsorship and advertising could provide the necessary capital for such a mass media educational plan.

And finally before we can expect the public to recognize and respond to climate change by making educated, environmentally, friendly consumer purchases, there is a paramount need to encourage all levels of government to get their own houses in order. Creative initiatives need to be developed to encourage constituents to first understand the ramifications of climate change, and reward those prepared to tread more gently on this land.

The mounting social and economical implications of severe storms and changing weather will continue to stress the importance of constructive, progressive, discussions with government and industry educators. The time is now to encourage this logical progression, by addressing our environmental responsibilities with much friendlier, safer, building practices. ❑

Count Me In! Results of a Research Project to Measure the Impacts of Thirty Workplace-based Workshops to Raise Awareness of Climate Change and Stimulate Personal Action

Maria Kelleher

This paper presents results of a 12-month research project delivering workplace-based training on climate change and energy efficiency to Canadians at different work locations. By June, 2000, the workshop has been presented to 732 Canadians in 32 different workplaces, and resulted in personal pledges to take actions which will reduce CO_2 *emissions by an average of 1.9 tonnes per participant per year. Follow-up monitoring is on-going through an interactive database and web page, linked by e-mail to the workshop participants.*

1. INTRODUCTION

The *Count Me In!* workshop was designed to communicate the issue of climate change to the Canadian public through workshops delivered to groups of 25 to 30 people at their place of work. The workshop explains climate change, and then focusses on 30 actions which people can do in their home lives and while travelling to reduce CO_2 emissions. The workplace was chosen as a convenient location to access large groups of Canadians.

Enviros RIS designed the workshop curriculum and materials, and received a contribution from the Climate Change Action Fund to deliver the workshop at 30 work locations (Energy Innovators, governments and other locations) and monitor the impacts on behaviour change among participants.

The *Count Me In!* program not only raises awareness but encourages individual action on limiting the potential impacts of climate change through energy efficiency. *Count Me In*! is an innovative training program for several reasons:

- focused on employee based training;
- full endorsement of employer;
- highly interactive 2 hour workshop on climate change and the importance of energy efficiency
- does not focus on awareness building alone, but includes personal action;
- introduces a National Voluntary Pledge program to encourage individuals to make commitments to undertake individual actions to reduce personal GHG emissions in their home and while travelling; and
- includes a monitoring system which measures the greenhouse gas (GHG) savings that are committed by workshop participants, and follows up to determine what is saved through their completed actions. The follow-up program and the personal signing of a pledge form are social marketing techniques which are very important elements in encouraging ongoing change in behaviour and increasing awareness.

The marketing, organising, and delivery of this program has provided a great deal of insight to identify the various barriers to raising awareness and promoting action on climate change. Most important, this program was designed to be flexible and allow the testing of different methods to identify the best approaches to engage Canadians on the climate change.

2. BACKGROUND

In 1997, Enviros-RIS carried out initial research on finding the "Blue Box of Climate Change". We were looking for a simple action which individuals could take which would raise awareness of climate change, and change behaviour in a way which would contribute to the solution. This was achieved in the Blue Box case, because people could recycle, and feel they were contributing to solving the landfill crisis which was in place in Ontario in the mid to late 1980's, when Blue Box recycling gained its popularity. Providing Ontario households with Blue Boxes helped to raise awareness of environmental issues, and the need to change behaviour from wasteful to more conserving practices. Finding a simple icon like the Blue Box was more challenging for climate change, because the issue is more complex, and more difficult to explain to the public.

Enviros RIS developed the concept of workplace based training, which would raise awareness of the climate change issue, and also offer options for action to Canadians. A National Personal Pledge system was envisaged at the time, whereby actions by individual Canadians would be added to a total pledge by individuals, which could then be a challenge to other sectors to do more.

Environment Canada funded a feasibility study on the concept in early 1998. Enviros RIS staff interviewed 25 senior executives at companies across Canada to test the concept, as it was essential that the program have private sector support. The interviews identified a short, 2-hour workplace based training program as the best method to access Canadians and raise awareness on the climate change issue. The endorsement of the employer was considered an important message to give to employees.

Enviros RIS developed the curriculum for the program, which was named the Count Me In! program in Summer 1998, to cover:

- Climate change
- Energy efficiency and
- What people can do in their own home lives and while travelling to reduce CO_2 emissions.

The program was pilot tested at an insurance company in October, 1998, and the design was modified over time to the current final product.

In December, 1998 the Office of Energy Efficiency at NRCan endorsed a submission which Enviros RIS made to the Climate Change Action Fund (CCAF) to test the workshop at 30 locations, and identify the impacts of the program. The CCAF made a contribution to Enviros RIS in April 1999 to carry out the proposed research, which is nearing completion at this time.

3. WORKSHOP RESULTS

The workshop itself is described in a separate paper in these proceedings (KOMLJANEC). This paper will focus on the results.

To date (June 2000), the workshop has been delivered to 732 participants at 39 workshops at 32 work locations shown in Table 1.

The participating work locations include 13 Energy Innovators, 12 government offices and 7 small companies and community groups. Among the 732 workshop participants, 83% registered formal pledges to reduce greenhouse gas emissions. Those not completing the pledge forms, for the most part, were participants that had to leave early from the workshop. A handful of participants felt uneasy about the pledge and declined to participate.

Workshop participants have pledged to reduce a total of 1,163 tonnes of greenhouse gases in their homes and on the road, which averages 1.9 tonnes per participant. The order of priority of pledged greenhouse gas reduction activities from highest to lowest is transportation related activities (27% of total pledges), miscellaneous activities

Table 1

Locations Where Count Me In! Program Delivered

Companies	Government
3M Canada	City of Burlington
AT&T Canada	City of London
Automotive Parts & Manufacturing Association	Halifax (RM)
Caledon Countryside Alliance	Town of Markham
Canadian Tire Corporation Ltd.	NRCan (OEE)
Corporations Supporting Recycling (CSR)	City of Toronto Waste Watchers
Dofasco	MOE (Drive Clean Staff)
Dupont Canada Inc.	Nova Scotia (DOE) & (DNR)
Kodak Canada Inc.	City of Ottawa
General Electric (CFB Halifax)	Ottawa-Carleton (RM)
Interface Inc.	City of Toronto
Molson Canada	New Brunswick (DNR)
Mount Saint Vincent University	
Nortel Networks	
Slater Steel	
IBM	
RWDI	

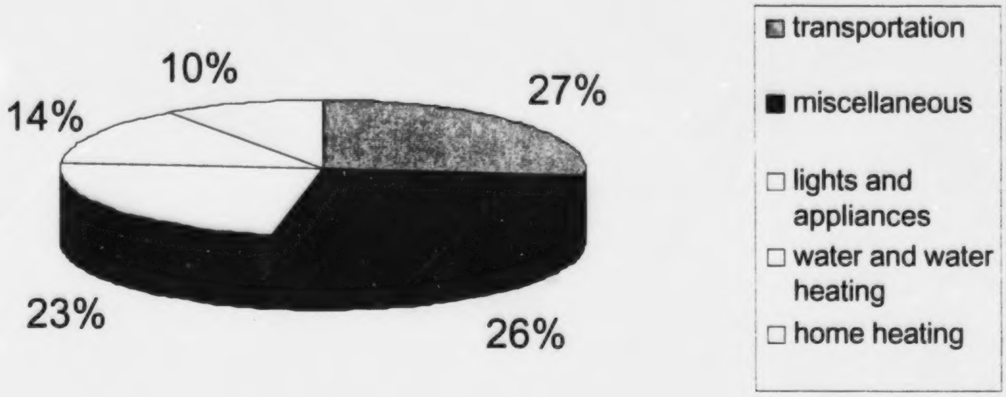
(26% of total pledges), lights and appliances related activities (23% of total pledges), water and water heating related activities (14% of total pledges) and home heating related activities (10% of total pledges) - see Graph 1. Detailed pledge activities for each of the categories is provided in Graph 2.

The ten most commonly pledged actions in order of highest to lowest commitment are as follows:
1. Keep tires fully inflated (50% of participants pledged to pursue this activity)
2. Turn off lights when not in use (39% of participants pledged to pursue this activity)
3. Recycle more (38% of participants pledged to pursue this activity)
4. Reduce speed (34% of participants pledged to pursue this activity)
5. Reduce idling (33% of participants pledged to pursue this activity)
6. Turn off computer at night (29% of participants pledged to pursue this activity)
7. Fix leaky faucet (27% of participants pledged to pursue this activity)
8 Caulk and weather-strip doors and windows (26% of participants pledged to pursue this activity)
9. Avoid non-recyclable packaging (25% of participants pledged to pursue this activity)
10. Switch to compact fluorescents (25% of participants pledged to pursue this activity)

Two other key parameters which were measured at the workshop were:

- The awareness of participants on climate change was measured at 80% before the workshop, and 89% after, using a standard test, showing that the workshop increased awareness of climate change.
- Workshop participants rated the statement *I believe that limiting climate change by conserving energy is the right thing to do* as 5.4 out of a possible score of 6.

Graph 1: Pledge Related Activities



4. FOLLOW UP AND MONITORING

The Count Me In! workshop includes a follow-up and monitoring component, to try and track longer term behaviour change as a result of the workshop. This element of the program is still underway, and will probably be incorporated into the ABC (Action By Canadians) program managed by the Energy Council of Canada, and also supported by the CCAF, when this Count Me In! research project is completed. The design of the follow-up and monitoring program has changed over time and different approaches have been tested. The current approach is to send three follow-up messages to each participant:

- The first message within 2 months of the workshop;
- The second message within 6 months of the workshop, and
- The third message within one year of the workshop.

To date, the following follow-up approaches have been used with different Count Me In! workshop participants:

- 363 received follow-up e-mails;
- 22 received follow-up faxes, and
- 41 received follow-up by mail.

Responses have been received from 126 participants to date. The 10 most commonly reported completed actions by respondents to the follow-up efforts from highest to lowest commitment are shown below, along with the ranking of the same action when the original pledges were made at the workshop:

1. Install low flow equipment (not listed as a top ten pledged activity)
2. Turn off lights when not in use (#2 on the top ten pledged list)
3. Keep tires fully inflated (#1 on the top ten pledged list)
4. Reduce speed (#4 on the top ten pledged list)
5. Recycle more (#3 on the top ten pledged list)
6. Reduce idling (#5 on the top ten pledged list)

7. Fix leaky faucet (#7 on the top ten pledged list)
8. Turn off computer at night (#6 on the top ten pledged list)
9. Run dishwasher when full (not listed as a top ten pledged activity)
10. Avoid non-recyclable packaging (#9 on the top ten pledged list)

Many of these activities require minor changes in behaviour and minimal capital expenditure. Once the participants have successfully adopted the "easier" pledge activities, they can be further encouraged to engage in pledge activities requiring greater commitment (i.e. in time, resources and/or behaviour).

Self Reported Increased Awareness:

Following the workshop, participants who reported taking action, reported that since the workshop they considered themselves to be more aware about:

- climate change (92% felt they were more aware);
- personal energy use (93% felt they were more aware);
- TV programs on climate change (54% felt they were more aware);
- articles in the newspaper and magazines about climate change (77% felt they were more aware).

Other Self Reported Actions:

- 36% of participants that reported taking action who found themselves conducting further research on their own (through Internet, or reading books) on climate change.
- 4% of participants who reported action reported that they had conducted or arranged for a home energy audit to be conducted on their home since attending the workshop
- 66% of participants reported they installed the faucet aerator they received at the workshop.
- **48% reported that they had attempted to take public transit since they participated in the workshop.**

5. NEXT STEPS

The Count Me In! research project will be completed shortly, and a report prepared summarizing the research findings, and suggesting options to continue the program in the future. ❑

6. ACKNOWLEDGEMENTS

Enviros RIS would like to acknowledge the financial contribution of the Climate Change Action Fund, which allowed this research to take place; the on-going support we have received from NRCan staff throughout the project, and the significant contributions made by the staff and coordinators at the 32 locations where the Count Me In! program was delivered

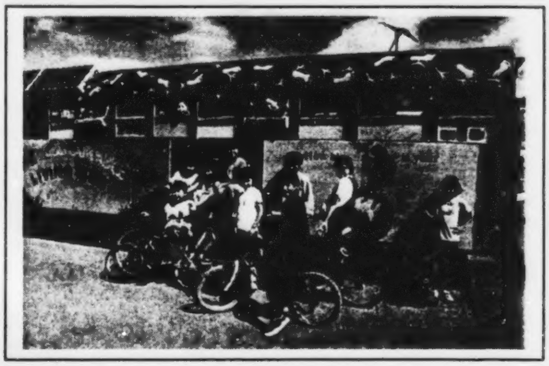
The Sustainable Living Bus - Motivating Change

Lisa Mitchell

Powered by alternative energy sources, and filled with hands-on displays, the Sustainable Living Bus travels to schools and communities to motivate action on climate change. Participants learn how they as individuals impact the environment and what actions they can take to reduce their ecological footprint and live sustainably. Solutions demonstrated on the bus directly address climate change and greenhouse gas emissions. Personal responsibility is a key concept built into the program so that participants feel empowered in the face of the enormity of the climate change challenge, and will take action at home, work and in the community.

INTRODUCTION

The Sustainable Living Bus is a public outreach project that uses hands on educational displays to promote solutions addressing the issues of climate change and environmental sustainability. The purpose of the Bus is to introduce people to concrete and practical lifestyle alternatives, which will help them to live with less impact on the environment.



Picture a propane-powered school bus with solar panels and a wind generator on the roof. Inside there are interactive displays on sustainable shelter, energy and water use, transportation, recreation, food and consumer choices. You can touch a straw-bale wall, see worms composting, compare the energy needs of various power-saving appliances, and watch the water from a shower flow through a grey-water filtration system. As you stroll through the bus you can sip on a cup of organic coffee, ground with a pedal-powered grinder, and brewed in a solar-powered coffee maker!

The solutions demonstrated on the bus directly address climate change. Visitors see how photovoltaics work and how alternative energy can be used. They can try out different light bulbs, learn about energy conservation and discover how to retrofit homes. Alternative construction techniques, such as straw bale housing, cob wall or high efficiency insulation are highlighted. They can learn about fuel alternatives like natural gas and propane. Most importantly they learn practical hands-on solutions for living a conservation-oriented lifestyle.

AN IDEA INSPIRED BY THE SOUTH

The Sustainable Living Bus was developed by the GAIA Project, a unique partnership between the Sierra Club of BC and the Salvadoran Centre for Appropriate Technology (CESTA).

The bus was inspired by the Eco-Centro, land purchased by CESTA in El Salvador to demonstrate appropriate technologies that address local environmental and social problems and conserve resources. Our goal was to make a mobile Eco-Centro for Canada that introduced ideas that made practical sense in our own country. We decided that the best way reach a larger number of people was to bring solutions to people using a mobile demonstration center that could visit communities across the country.

Three years ago, in the northern BC community of Smithers, construction of the Sustainable Living Bus began. Volunteers and youth interns worked together to take the seats out of a 72 passenger yellow school bus and to build and install interactive displays.

This spring the Sustainable Living Bus was given a whole new look. With the help of Sooke artist Bill Dixon, and the volunteer efforts of the Sooke community, the outside of the bus was transformed into an interpretive tool illustrating the themes conveyed on the inside of the bus.

A VEHICLE FOR YOUTH EMPOWERMENT

FIGURE 2: Youth Interns on Bus

The Bus is more than just mobile displays. It is a vehicle for youth empowerment. On the Sustainable Living Bus, youth are the catalysts for engaging the general public. They develop programming that takes a fresh and relevant approach to sustainability, and captures the minds of children and adults alike. In their roles as bus interpreters, youth are not only developing the skills that enhance their career futures, they act as mentors to a younger population by modeling environmental responsibility and leadership.

The bus is operated by youth interns who are funded by several programs including the Canadian International Development Agency and the Department of Foreign Affairs and International Trade. Since "day one" of the project, youth have been involved in designing the bus, building displays, conducting school programs, and making decisions about the future of the Sustainable Living Bus. The youth spend the first part of their internship working on the Bus, then head down to El Salvador where they work on the many fantastic project being developed by our partner organization, the Salvadoran Centre for Appropriate Technology (CESTA).

The youth who work on the bus return to their communities as leaders in the environmental movement, bringing with them the energy, ideas, and commitment to action that they learned while working on the bus, and in El Salvador. A group of four Metis interns, have almost completed their internships with our organization. When they began working with our organization they had little understanding of climate change and the associated environmental issues. During their internship they have developed a strong understanding of water and energy consumption, waste management, alternative home design, sustainable transportation and climate change. When these youth return to their respective communities, in rural Manitoba and British Columbia, they will be empowered to bring with them the knowledge, tools and potential to create lasting change.

HIGH PROFILE AND MOBILE

Last year the Sustainable Living Bus brought information and solutions to 31 communities in the province of British Columbia, and conducted programming in over 33 schools. Because of the mobile nature of our project we have the ability to reach out beyond urban centres and touch people in isolated rural communities. Last summer the bus visited remote First Nations villages such as Gitanyow, and Gitwangak, and left a lasting impression in communities like Summerland, BC where members of the community, including the Mayor turned out in droves, to see the bus.

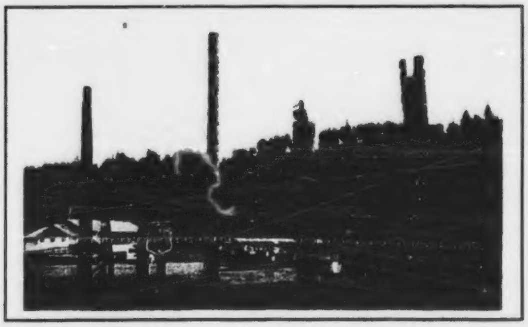


FIGURE 3: Bus in Gitanyow, BC

The bus is a huge attention grabber. It doesn't drive down the street without turning the head of everyone it passes by. It doesn't visit a school, or community without creating interest, dialogue and action around the issue of sustainability.

AN "ENGAGE, TEACH, EMPOWER" MODEL

Of the many possible barriers to initiating significant changes in personal behaviour, one of the most difficult to overcome is that which stands between awareness and action. The Sustainable Living Bus, through its adoption of an "engage, teach, empower" model for catalyzing personal change, serves as a bridge between an understanding of local and global environmental issues, and change through action.

FIGURE 4: Children in Bus

We recognize that people learn in many different ways. While some learn best by reading facts and figures, the majority of us are visual learners – i.e. we learn more effectively by seeing something in action and participating. The Sustainable Living Bus provides an opportunity for people to see and touch, spin cranks, toggle switches, and flip panels. Murals and photographs on panels provide relevant informationon environmental issues, while the hands-on stations allow people to *see* worms composting garbage, *touch* straw-bale walls, *compare* the amount of energy drawn from various power-saving appliances, *learn* how to make household cleaners from environment-friendly materials, *watch* as the greywater from a shower filters through gravel to nourish an organic garden, and *eat* a bowl of "solar popcorn". The displays bring the issue of climate change to a personal level and show people how to act responsibly.

A SUCCESS STORY WHEREVER IT GOES

Since its inception in 1998, over 12 000 people have directly experienced the Sustainable Living Bus. In the fall of 1998 the bus visited 17 schools over a 22 day period between November 9 and December 15. In the summer of 1999 it toured 31 British Columbia communities, travelling as far north as Prince Rupert and as far south as Osoyoos. In each of the communities the bus received excellent media coverage, extending its message of sustainability through radio and television stories about the bus. A news clipping, aired on the television station in Kelowna, attracted such attention that people who had missed seeing the bus at the local Farmers Market chased down the bus and asked when they would be able to see it next. The following day we had an enormous crowd of visitors in Vernon, who had seen the news story, and wanted to experience the bus and its solutions first hand. The same news clipping is now part of an advertisement for the local news station, reminding Okanagan residents over and over again about the messages brought to them by the Sustainable Living Bus!

> "On the drive to the Vernon Farmers market, we picked up a paper at the gas station in Kelowna. On page 3 of the paper we found a huge picture of Lisa, the pedal powered coffee-grinder and our new sandwich board advertising the bus and our sponsors. As a result of the excellent media coverage we received in Kelowna we had a fantastic turn out in Vernon. Many people who came to the bus did so because they had seen us on the news the previous evening! Bus boy is now a local celebrity!" Sustainable Living Bus Journal, August 12, 1999.

The media attention has had a visible impact on our programming. Now rather than soliciting schools and communities to book the bus we receive requests from all over the country asking the bus to visit schools and events. This fall our tour of the Lower Mainland was fully booked before we even advertised, and groups like Youth Challenge International, as far away as Toronto, are requesting us to attend events. We have also had staff from the Vancouver Museum visit our bus to develop ideas for their "backyard biodiversity" display.

A LASTING COMMITMENT FOR CHANGE

Each time a student leaves the bus they are asked what they are going to do to "keep the planet healthy" and reduce their environmental impact. As a result we have received thousands of verbal declarations from students telling us how the bus has influenced them to change their lives. These declarations have been supported by recycled postcards that students have sent us to tell us about what they have done to make their lives more sustainable.

> "Thank you for letting us go in the bus. I learned that we should not pollute the air. I will change by walking more instead of my mom driving the car." Mathew, Grade 5.

Our programming is successful because it not only creates awareness — its inspires a commitment to action and change. ❑

Using the Climate Change Calculator to Link Lifestyle Choices and Environmental Consequences

Wendy Avis

ABSTRACT

The Climate Change Calculator is an interactive software tool designed to raise people's awareness of the greenhouse gases they produce through their daily activities and lifestyle choices. The objective of this Canada-specific software is to help people of all ages learn about their contributions to greenhouse gas emissions and suggest measures they can take to reduce emissions.

The Climate Change Calculator collects information from the user by identifying their place of residence and by characterizing their key lifestyle choices. The user is guided through a graphical Canadian neighbourhood containing icons on home heating and cooling, appliances, transportation and recreation where they answer a series of multiple-choice questions. This information is then used to estimate personal CO_2 *emissions. In addition, a useful reporting function shows a graphical emissions breakdown for each feature. All throughout, a convenient and sophisticated Help system provides answers to the user's questions.*

This innovative integrated assessment model (IAM) revolves around the individual user and helps to raise the issue of climate change in a personal and powerful way. The Climate Change Calculator is being used in a number of different and innovative settings.

The Climate Change Calculator is one integrated assessment tool being used in the Vancouver ULYSSES (Urban LifestYles, SuStainability and Integrated Environmental Assessment) Project, which convened citizen focus groups to discuss the relationship between participants' personal lifestyles and their cumulative environmental consequences - particularly as they related to climate change. Through these exercises, lessons were learned about the usability of the Calculator and about the usefulness of integrated assessment models in motivating behavioural change.

The Climate Change Calculator is also being used by environmental educators across the country. The Pembina Institute has developed curriculum materials which complement the Calculator, enabling a educators to have access to this IAM for use in the classroom. In addition, Science World in Vancouver is developing a kiosk version of the Calculator as part of their Living Planet exhibit.

In this multi-media presentation, I will examine how effectively the Climate Change Calculator raises awareness of the link between personal lifestyle choices and environmental consequences and helps to motivate change. I will make recommendations based on the lessons learned in the development of this personal IAM which may apply to future design and use of IAM's. These results will help to address how integrated assessment models can engage the public and help to feed into the process of developing solutions to environmental problems. ❑

Session F3

STAKEHOLDER ENGAGEMENT 2: AGRICULTURAL SECTOR

Planning for Climate Change in Agriculture
Alison Blay-Palmer
University of Waterloo

Achieving Understanding in Agricultural GHG Emission Reduction
A. Hucq[1], J. Kowalski[1], L. Gutek[2] and R. Gray[1]
1. University of Saskatchewan
2. Saskatchewan Agriculture and Food

How is Climate Change Relevant to Farmers?
B. Smit, E. Harvey and C. Smithers
University of Guelph

Planning for Climate Change in Agriculture

Alison Blay-Palmer

Climate is a key factor that dictates what can be achieved in agriculture. Given changing climate, farmers need a range of tools at their disposal as they adapt to new climatic conditions. From empirical research, physiological, institutional, economic and market barriers impeding the development of climate related innovations were identified. Given these limitations, it would seem prudent to communicate climate change concerns to breeders to assist them in raising the profile of climate change as a priority issue in breeding programs. Borrowing from the hazards research literature, approaches are recommended for facilitating the communication of climate change issues.

INTRODUCTION

In reviewing the academic literature and government publications related to climate change and agriculture, there is a clear need to bring together what Cohen (1999) characterizes as the lab and the street. Within Canada, the primary thrust of initiatives related to climate change is on the mitigation of green house gases (GHG), with only modest attention paid to adaptation to changed climatic scenarios (National Climate Change Secretariat 2000; Environment Canada 2000; Bruce *et al.* 1999). One of the few calls for adaptation by agriculture in Canadian government publications is found in an Option's Report prepared for the National Climate Change Secretariat:

> Governments should co-operate with private sector partners to develop a strategy that will enhance the agricultural sector's ability to adapt to climate change using sustainable farming methods.

Even if implemented, the Kyoto commitments will not halt the accumulation of GHGs in the atmosphere – some amount of climate change is inevitable. It is in the interest of the agricultural sector to develop a long run strategy to enhance the sector's flexibility to adapt to climate change. This adaptation will reduce the sector's vulnerability and increase its ability to capitalize on opportunities as they emerge. (National Climate Change Secretariat, p.32)

Clearly, the Canadian government acknowledges future climatic changes, as well as the need to develop adaptations to meet these challenges.

In order for effective adaptation to climate change to occur, there needs to be a dialogue and interaction between scientists and lay people so that individuals developing innovations in all sectors of the economy can include climate change scenarios in their planning process. One of the difficulties in making this a reality is communicating scientific concerns in a meaningful manner.

To understand the importance of communicating climate change issues to those who can effect change and develop adaptations, it is instructive to turn to areas where it has been necessary to manage and communicate risks to the public. One example comes to us from the hazards research literature. Burton, Kates and White (1993) outline procedures and communication methods for early-warning systems in the cases of environmental hazards such as tsunamis, tornadoes, and floods. More recently, Bruce, Burton and Egener (1999) prepared a report for Emergency Preparedness Canada in which they outline potential mitigation strategies for Canada as it faces climate change, and areas that could be targeted using established emergency preparedness protocols. Agriculture is one area identified as requiring some work.

THE IMPORTANCE OF AGRICULTURE IN ONTARIO

Agriculture and related agri-food businesses are the second largest employer in Ontario after the automotive industry. Presently, the major cash crop in Ontario is soybeans representing $200 million in annual sales at the farm gate (Ontario Soybean Growers' Marketing Board 1998). As such agriculture is an important component of the Ontario economy. Decisions made with regard to protecting and planning for agricultural production could have profound impacts for both food supply and economic activity. The following section describes how agriculture is affected by climate.

Possible Impacts of Climate Change: Variability and Changing Means

There are two components of climate that affect agriculture. These are climatic variability and climate change. The first refers to inter-annual fluctuations and is a point readily understood. Basically stated, the weather this year is not the same as the weather last year or next year. Annual mean temperatures and rates of precipitation tend to vary.

As well as this variability between years, there is a suggestion that mean values may be shifting over time (Intergovernmental Panel on Climate Change 1994; Canadian Climate Program Board1993). Given that present coping ranges for agricultural systems are developed to deal with current climatic conditions, any shift in mean values without a corresponding shift in coping ranges would leave the production system more vulnerable (Smit *et al.* 1999). This underscores the need for adaptation strategies that allow for adjustments to new climatic conditions.

In order to deal with these possible changes, it is necessary to develop tools for farm producers. This is crucial as farmers need to have resources for coping with possible changes in average climatic conditions and increases in extreme climatic events. Some experts believe that changes to climate will be gradual enough that we will have time to develop adaptations as needed. This belief is especially entrenched in agriculture (e.g. Pinstrup-Andersen and Padya-Lorch 1999). As well, there are expectations that technology will address the planet's growing food needs. The United States Department of Agriculture (USDA) anticipates the doubling of field grain, wheat and soybean yields from 1980 levels by 2030 (Council for Agricultural Science and Technology 1992). The following empirical research questions these assumptions. It underscores the extent to which plant breeders in agriculture are concerned about, and able to account for climate change as they develop adaptations and innovations for crops.

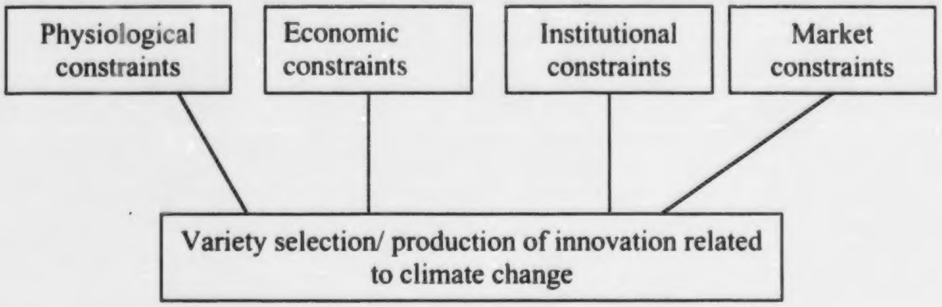
TECHNOLOGY AS AN ADAPTATION TOOL FOR CLIMATE CHANGE: THE CASE OF ONTARIO SOYBEAN BREEDERS

In order to define breeding priorities and research agendas related to climatic conditions more clearly, an empirical study was undertaken (Blay-Palmer 1999). The research used a key informant approach, supplemented by an extensive review of academic, industry and government literature. Interviews were conducted with experts in the Ontario soybean breeding industry. The goal was to determine how technology has served, and may continue to provide, adaptation for agriculture in the face of climatic change and variation. A total of 21 experts were interviewed, including crop breeders/ researchers, marketing specialists, and farmers, from academic, government and private corporations. The analysis of these interviews revealed some potential pitfalls in breeding programs, highlighting areas where more focus is needed in providing coping tools for climate change scenarios.

Identified Challenges for Soybean Breeders

The most notable finding related to awareness of climate change and associated risks by breeders was the identification and specification of issues that competed with climate for research focus and dollars (Figure 1). These include physiological, economic, institutional and market constraints. All of these forces restrict the breeder's ability to consider climatic conditions as a top priority.

FIGURE 1. Breeding Constraints Challenging a Climate Change Focus


Physiological constraints
Economic constraints
Institutional constraints
Market constraints
Variety selection/ production of innovation related to climate change

Blay-Palmer 1999

Physiological challenges

Three key biological constraints were identified during the interviews (Table 1). First, interview subjects indicated that when undertaking plant breeding it takes a minimum of eight years to get a crop innovation to market. Briefly, it is necessary to:

1. introduce the innovation into the plant
2. develop a reliable and consistent variety that always demonstrates this trait
3. secure the approval and certification for the variety
4. produce enough seed for sale.

This time frame assumes that the desired trait has been identified. If this is not the case the process could take many more years.

TABLE 1. Summary of Key Physiological Barriers for Developing Innovations

Challenge	Breeding implication
Minimum 8 years to introduce innovation	Potential lag between needing an innovation and having it available
Complex genetic traits	Inability to develop traits rapidly, or at all
Accelerated breeding periods	Less exposure to environmental constraints

Blay-Palmer 1999

The second barrier relates to the number of genes involved in a trait. For a complex trait such as drought tolerance where multiple genes are involved, some interview subjects indicated that the process could be substantially longer than the minimum eight years. This additional time would be needed to understand which genes are involved in the trait and how they relate to other traits. The fact that many traits related to climatic conditions are complex, means that breeders could need several years lead time on top of the eight year minimum to develop new varieties.

A final concern that was raised during interviews was the speed of innovation. As varieties are developed more in a simulated environment, there is less exposure of plants to actual climatic conditions. The concern in this scenario is that breeders cannot know how traits will respond to actual climatic conditions until subjected to outdoor trials. If this exposure is minimized due to accelerated breeding program, while climatic conditions are changing, then the opportunity for exposure to altered scenarios in the real world is lost.

A case in point was raised by some of the interview subjects. In the late 1980's and early 1990's some varieties were introduced into the Ontario market directly from the United States. However, as growing conditions are somewhat different between the two locations, with Ontario manifesting lower night temperatures, flowers were damaged during the cooler nights. Although Canadian breeders had introduced genetic material into Ontario soybeans in the 1970's to successfully overcome this problem, this genetic material was lacking in the U.S varieties. As a result, the plants without this cold night tolerance had significantly lower yields in 1992. In response to this problem, U.S. companies ensured that subsequent breeding programs included plant exposure to actual Ontario climatic conditions. This response underlines the need for *in situ* breeding, over a sufficient period to allow exposure to a range of climatic conditions.

Economic Barriers

There are two primary economic impediments to developing innovations, both related to the high cost of conducting biotechnology research. Whereas conventional research and development program budgets have ranged from the tens of thousands to hundred of thousands of dollars in the past (Ontario Soybean Growers' Marketing Board 1988-1998), current biotechnology research budgets require millions of dollars. This escalated scale of financial commitment has two effects. First, fewer research initiatives may be considered, as each initiative is so costly. This means that climatic considerations must vie for limited research dollars with other research priorities. Second, this level of expenditure results in increased alliances between public and private researchers, creating a more consolidated industry with more influence from private interests than before. That what is now called the first generation of biotechnology crops was directed at pest management and herbicide tolerance, and not broader crop adaptation or human health benefits, raises serious concerns for some researchers regarding the influence of corporate agendas.

A final factor contributing to the rocketing costs of crop breeding is the patenting of innovations. According to interview subjects, this is limiting access to genetic and breeding technology breakthroughs as well as increasing the costs of programs. At this point, most biotechnology innovations are cumulative in nature (Horbyluk 1993), requiring that one have access to previous innovations to introduce new ones to the market. Purchasing the rights to these innovations can be very costly and therefore limiting.

Institutional Considerations

One of the consistent comments from interview subjects was their observation of change in the relative involvement of the public and private sectors. This shift in influence toward private breeders is clearly indicated by the number of soybean varieties approved between 1967 and 1998 (Table 2). In 1975, 10% of the varieties were privately owned, with 90% in the public domain. By 1998, the reverse scenario existed; 90% of varieties were held by private interests, while public breeders had only developed 10% of the available varieties.

Some interview subjects found this trend to be worrisome when they considered the type of research conducted by public versus private institutions. The traditional role of public breeders has been to undertake research to improve both crop varieties and the knowledge-base. Sederoff and Meagher (1995) refer to this as research motivated by intellectual curiosity. In the National Biotechnology Advisory Committee report (1998), Nicholson, a Board Member of the Canada Foundation for Innovation, states:

> The trend away from curiosity-driven research in favor of highly directed investigation –which is today, toward an incremental approach to innovation that is really sophisticated problem-solving – must not be taken too far. Otherwise, we will deplete the wellspring of truly fundamental innovation on which sustained improvement in the human condition depends (NBAC 1999, p.3.3).

As explained by a key informant during an interview, public researchers undertake some research to satisfy

TABLE 2. Absolute and Percentage Number of Varieties Offered by Public and Private Breeders, 1967-1998

Year	Total number of varieties	# of public varieties listed in field crop trials		# of private varieties listed in field crop trials	
1967-1970	5	5	100%	0	0%
1975	10	9	90%	1	10%
1980	22	9	41%	13	59%
1985	44	12	27%	32	73%
1990	78	20	26%	58	74%
1995	107	19	18%	88	82%
1998	132	13	10%	119	90%

Ontario Oil and Protein Seed Crop Committee 1965-1998

intellectual curiosity and explore avenues that may not be obviously profitable at the outset. Some key innovations in conventional breeding have resulted from this sort of approach. One example is the previously mentioned development of cold night temperature tolerance. Although this was not an expected outcome of the early 1970's Ontario breeding program, the innovation proved to be significant as it enabled the spread of soybeans out of southwestern Ontario, into eastern parts of the province. This increased the soybean acreage in the province from just over 400,000 acres in 1976 to almost 2.25 million acres by 1996 (OSGMB 1999). By not engaging in this curiosity driven research, important innovation opportunities for climate change adaptations may be missed.

Marketing considerations

Although this area was not explored in depth, two areas related to marketing were identified that compete with climate change for research resources. These are:

1. new market niches for soybeans, and
2. the pressure to develop other new breeding technologies.

First, recently some soybeans have been developed to fill niche market needs. An example is the development of varieties that have certain improved qualities such as specific oil and protein profiles. The goal has been to offer varieties to growers that can be sold into niche markets such as the Asian market where demand for specialty foods such as tofu products are in demand. This offers farmers a way of differentiating themselves within a highly competitive market.

Looking forward, breeders have also been seeking to develop the 'nutraceutical' qualities of crops. In the case of soybeans, for example, this means increasing levels of isoflavones that are thought to have anti-carcinogenic properties. If breeders can increase the levels of isoflavones, this has the potential to broaden the market viability and value of soybeans as a crop. Soybean varieties are also being developed for use as ink, fiber products for building materials, and as a plastic and lubricant alternative. All of these special market opportunities, or niches, compete with climate as breeding consideration when research agendas are established.

Sources of competition for development resources referred to in (2) above have become varied and wide-ranging, and are now more evident with the advent of biotechnology. One example is the development of what has been dubbed the Terminator technology. This would render second generation seeds sterile, requiring farmers to purchase new seed every year from seed companies. This research, and other such technologies related to market issues, is very costly to develop with substantial research time lines. These technological initiatives detract from the consideration of climate change as a breeding priority.

Breeding trends in general

A final relevant finding is that some of the crop breeders interviewed expressed the concern that varieties are being developed for narrower rather than broader climatic conditions. From the perspective of climate change this is especially important if one recalls that climate change experts expect that wider rather than narrower coping ranges will be needed in the future to deal with a greater number of anticipated extreme climatic events.

CONCLUSION: THE NEED FOR IMPROVED COMMUNICATION

Given the lengthy time line needed to develop new varieties, and the constraints on research resources, it would be advisable for plant breeders to understand the sorts of climate changes that farmers could be facing. This would allow them to advocate for and develop a range of varieties in a timely manner. It would also assist them as they present their agendas for funding. This sort of forward planning is currently being done as part of a pest management strategy for soybeans in Ontario. Plant breeders in Ottawa are anticipating the spread of a parasite from southwestern Ontario northeast into the Ottawa area. As a result they are developing varieties for the Ottawa area that have all of the desirable traits for that area and incorporate pest resistance. This is a clear example that where direction and will demand, steps can be taken to prepare for future events.

These are the barriers that soybean breeders presently confront. In considering climate change, breeders and those who give breeders direction need to be made aware of the implications of climate change for crop production. Although specific regional forecasts are obviously not possible, they could be provided with information regarding the ranges of threats and the associated risks accompanying projected climatic change and increased variability for their areas. For example, if increased incidents of drought are expected, then crops that can tolerate these conditions could be developed. In future, this would offer farmers more options to cope with the broader range of risks they may have to face.

In looking for solutions to communicating changing climate to individuals such as crop breeders and farmers, it is possible to draw from the experiences of agencies that have been involved in preparing for and aadapting to impacts of other natural disasters. Several such projects are available, one of which is a methodology developed by Wilhite (1996) to cope with drought. He outlines ten steps that have been modified to be suited for developing climate change adaptation strategies (Figure 2). The first step is to set up a national commission tasked with developing a broad policy and accompanying specific plan objectives (Steps 1 and 2). It is then necessary to identify and resolve conflicts between sectors that may be at odds with one another. For drought preparedness, Wilhite identifies environmental and economic sectors. In the case of climate change, these could include the adaptations listed in the 1993 report *Adaptation to Climatic Variability and Change.* The recommendations are organized by sector and include agriculture, the Arctic, coastal areas, ecosystems and land use, energy supply, fisheries, forestry, urban infrastructure and water resources (Canadian Climate Program Board 1993). These parameters are well suited to Wilhite's approach.

The fourth step in Wilhite's model is to develop an inventory of natural, biological and human resources as well as to determine the financial and legal constraints. The next two steps (5 and 6) can take place simultaneously. The first is to develop a plan, while the second is to specify research requirements and how institutions need to be supported. Step 7 requires the synthesis of the scientific and policy issues. This is followed by the implementation of the plan through both educational and training resources. The final step is the evaluation of how well the goals are being achieved.

Although this methodology was developed to cope with drought, it is readily adapted for climate change challenges. Essentially, it boils down to establishing policy with specific goals. The plan associated with goals is developed through consultation. This is crucial when looking for ways to communicate with stakeholders and include them in the process. The need for education and training in order to get the relevant information to those who need it is also specified. Finally, the process of evaluating the level of achievement based on the stated goals allows for an on-going assessment of progress.

FIGURE 2. Ten-step Methodology for the Development of a Climate Change Preparedness Plan

Appoint Commission
Step 1

State Policy and establish objectives
Step 2

Avoid and resolve conflict between environmental and economic sectors
Step 3

Inventory of resources
Step 4

Develop Plan
Step 5

Identify research needs and institutional gaps
Step 6

Synthesize scientific and policy issues
Step 7

Implement Plan
Step 8

Develop educational and training programs
Step 9

Develop and implement Plan evaluation procedures
Step 10

Wilhite 1996

This process bears a resemblance to those used in environmental impact assessment (EIA), cumulative effects assessment (CEA) (e.g. Economic Commission for Europe 1992; Canadian Environmental Research Council 1988) and other areas where communication with the public is needed. This is good news for those trying to relay information about climate change as models and institutional infrastructure exist with which to communicate the importance and urgency of climate change. It is important to transfer knowledge about climate change to those who can develop relevant adaptations for farm producers. As the National Climate Change Secretariat has stated, it is to the benefit of agriculture to prepare in an informed manner for climate change. ❑

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Achieving Understanding in Agricultural GHG Emission Reduction

A. Hucq, J. Kowalski, L. Gutek and R. Gray

Achieving greenhouse gas (GHG) emission reduction in agriculture is an important yet challenging problem. Emissions from the sector account for approximately 10% of the Canadian total. There is clearly a potential to reduce these emission. There are, however, many scientific and data gaps that make the prescription and verification of change difficult. Little is known about the GHG emissions from existing farming technologies or the potential to reduce these with alternative technologies. Agricultural land can serve as a sink for Canadian GHG emissions that could remove from the atmosphere a large portion of Canada's annual emissions. It has already been proven that extension programs and public outreach can enhance the adoption of technologies and a change in community level values and beliefs, for example, the widespread adoption of zero-tillage practices in Saskatchewan.

1.0 INTRODUCTION

This paper intends to explore the intricacies of achieving understanding of GHG emissions reduction in the agriculture sector. There are at least two things to consider when approaching this: 1) the science of agriculture GHG emission reduction and 2) the adoption of GHG emissions reducing technologies. There is not enough known about GHG emissions reduction to determine what form policy(ies) should take but enough is known to be able to promote the adoption of some strategies and farm practices. Additional information is required on defining the problems and opportunities and in accurately determining how effective these approaches are. The industry needs an accurate snap shot of current issues and objectives. In order to determine where extension should place it's efforts, there is a need to know what the message is, who the target is, and what the expectations are. At the present time there is lack of direction and definition.

The first section addresses climate change and agriculture and shows the unique position of this sector. The second section talks about the first type of information - the science - and how important this information is in determining the second type of information - extension. Extension is discussed in section three which includes as well some discussion of farm practices and technologies - what works and what does not work. The three entities represented in this collaborative work speaks to their own experience and the direction each is seeking on this issue.

2.0 CLIMATE CHANGE AND AGRICULTURE

Unlike carbon dioxide (CO_2) emissions from fossil fuel use, GHG emissions from agricultural production systems are not in direct proportion to input use making calculations of total emissions difficult. For example, while energy efficiency in CO_2 emissions has long been a public and private goal, efficiencies in emissions from methane (CH_4) and nitrous oxide (N_2O), which are much more complicated to achieve, have not been. It is important to keep in mind that agricultural production is very sensitive to climate change and that many agricultural activities result in emissions of GHGs.

GHG emissions in agriculture account for about 10% of total GHG emissions as defined by the International Panel on Climate Change (IPCC). However, there are two things to consider about the uniqueness of these emissions in the agriculture industry. One is that GHG emissions from agriculture are narrowly defined as the plant/soil/livestock production system and no consideration is given to other industries which are related to agriculture. The other GHG emitting activities which contribute to the production system include: transportation; the manufacture of chemical inputs; fertiliser inputs; farm machinery and vehicles; the generation of electricity and heat for barns and drying facilities; the processing of raw product into consumer food items; and production and distribution of fuels for farm use.

The other uncommon aspect to greenhouse gas emissions in agriculture is that emissions are based in biological processes (the plant/soil/livestock production system) around which there is still uncertainty regarding the processes controlling these types of emissions and about the potential for their reduction. Further research is needed to determine reduction strategies.

2.1 Agricultural Soils As A Sink For CO$_2$

Agricultural soils can be either a net source or sink for carbon depending on the quantity and quality of soil organic matter and the management practices used. As a result, an opportunity exists to enhance agricultural soils as carbon sinks, thereby reducing atmospheric concentrations of GHGs. Suitable measures to enhance and maintain the carbon sink capacity of soils on the Prairies include:

- Minimizing the acreage of tilled summerfallow and moving to longer crop rotations;
- Reducing soil tillage which saves on both energy consumption and soil organic matter degradation;
- Improving new crop varieties and yields which can increase the absorption of carbon (C) in the soil;
- Increasing the amount of Prairie cropland returned to forage crops, which provides continuous soil cover and increases soil carbon; and
- Increasing energy efficiencies for all types of agricultural practices.

2.2 Adaptation and Mitigation

Adaptation generally refers to actions required to achieve adjustments to future changes in the global climate, such as increases in the frequency and magnitude of weather events (e.g., drought, floods and blizzards). Strategic directions for adaptation activities include:

- Enhancing communications and information networks involving the private sector, governments at all levels, the academic research community, and non-governmental organizations;
- Identifying regions and economic sectors most sensitive and vulnerable to the impacts of climate change;
- Determining appropriate adaptation responses, by integrating factors related to environmental and economic impacts and social acceptability;
- Improving environmental management and decision-making by incorporating possible climate change and variability impacts into the planning and decision process for all major projects and government programs; and
- Identifying where new or modified technology would be required.

Mitigation actions are designed to prevent or minimize the effects of climate change by reducing GHG emissions. Mitigation can be achieved through:

- The use of alternative sources such as solar and wind power;
- The use of ethanol and other renewable fuels;
- Building the organic matter in the soils;
- Reforestation; and
- "Reduce and recycle" options.

3.0 INFORMATION, MONITORING AND VERIFICATION

Over 250,000 Canadian farms are engaged in agriculture spread over 50 million hectares of land making agricultural land one of the largest environmental units managed in Canada (Switzer-House and Coote, 1984). These farms are diverse, even within one province, and their management differs from farmer to farmer, enterprise to enterprise, and area to area. This makes the monitoring and verification of individual actions difficult and expensive. As a result, observing what technologies are being used and using models for estimating GHG emissions may be, for the foreseeable future, the methodology for estimating agricultural GHG emissions. This diversity also plays a part in awareness and therefore, extension programs need to be geared toward making information accessible and available to all farmers across all management types. Getting this information to farmers requires a concerted and collaborative effort on the part of universities, government, non-government organisations and agricultural educators.

Two types of information are central to the tasks of finding ways to reduce emissions and measuring the progress towards that goal:

- Information about GHG emissions from the use of a particular technology will drive the public policy issue and any private investment initiatives;
- Information about how much each technology is used will determine the need for extension and outreach programs.

Both of these pieces of information are required to reliably estimate emissions from the sector.

Given that much of the information required to estimate the emissions from the sector is needed to drive private action and public policy to reduce these emissions, it makes sense to coordinate the flow of this information to be used for multiple purposes. There is need to be directly involved in public outreach, in the modeling of GHG emissions, and in the development of policies to reduce these emissions. Collecting data and reviewing literature to improve GHG estimates will ensure the data are used for various purposes and avoid costly duplication of activities. Climate change information for the agriculture sector would need to include short-term projects that would develop a primary inventory of the existing GHG emission data for Canadian agriculture, consequently allowing for the identification of data gaps, and helping to direct future research.

4.0 EXTENSION WORK

4.1 Background

In Saskatchewan, a number of organisations work toward increasing agriculture sector understanding of all issues. The Saskatchewan Department of Agriculture and Food's Extension Service Branch has an elaborate and accessible extension system in place that includes written material, face-to-face meetings with extension agrologists, and an electronic information system. One of the mandates of the Centre for Studies in Agriculture, Law and the Environment (CSALE) is communication of their interdisciplinary research information within and outside of the University. The Centre is devoted to extending this information to the farming public, and to inform and direct agricultural policy makers. Through the use of scholarly and popular publications, a website, and community outreach, CSALE has tried to fulfill this commitment. In turn, The Canadian Agricultural Energy End-use Data Analysis Centre (CAEEDAC) has worked closely with CSALE on GHG issues. CAEEDAC has a large database on energy use in agriculture and uses that database to update, determine gaps, and review energy use in farming technologies. The collaboration of these three units would prove to be powerful in achieving understanding in the agricultural sector of issues of climate change.

4.2 Technology Adoption Models

Adoption and diffusion are two concepts of change developed in the social sciences and accepted by extension practitioners (Warner and Maurer, 1989). Agricultural extension workers have been faced with the task of disseminating information from agricultural research (diffusion) and assisting in putting that information into practice on the farm (adoption).

Traditional models for the adoption and diffusion of technology may not have application in the case of reducing GHG emissions in agriculture due to the fact that some reduction mitigation may be legislated and compliance may be mandatory. However, until that time, adoption of technologies that will play a role in reducing the release of GHGs may follow the traditional pattern, especially if there is a perceived benefit for producers.

The original model of the diffusion and adoption of innovations include four elements:
it is "the process by which 1) an *innovation* 2) is *communicated* through certain channels 3) *over time* 4) among members of a *social system*" (Rogers, 1983). Characteristics of innovations are relative advantage, compatibility, complexity, trialability, and observability. Relative advantage is the degree to which the innovation is perceived as better than the one it replaces and compatibility is how consistent the technology is with existing values, past experiences, and the needs of adopters. Complexity, trialability, and obervability determine how fast an innovation will be adopted. The relative simplicity of an innovation and the opportunity to experiment and observe (especially first hand) will enhance faster adoption.

The complexion of the farm community has changed since this model was developed. The model was developed under the assumption that adoption of new technology is always good and that individuals have control over adoption practices. Today, however, there are at least two new factors which influence farmer decision-making which are macro- and micro-structural in importance: 1) environmental issues; and 2) the increasing necessity for off-farm income (employment).

A worldwide movement toward increased awareness of the environment has contributed to an interest in a more sustainable agriculture (Abaidoo, 1997; Kowalski, 1998). In the cases of GHG emissions reduction and endangered species (for example), legislation may play the dominant role in adoption of technologies. Real farm income has been dropping for many years (Fulton et al., 1989) resulting in the fact that more and more farmers are working off the farm and this can interfere with the ability to adopt practices because they become constrained by time and labour. However, some GHG emissions reducing technologies are time and labour saving, as well as money saving. In fact, a market for emission reduction credits would provide the opportunity to diversify farm income (Edwards, 1999).

4.3 Extension and Policy Efforts On GHG Mitigation

4.1.1 Saskatchewan Agriculture and Food (SAF)

In order for Saskatchewan farmers to participate in any meaningful discussions on this subject, more information is needed which would enable them a fuller understanding of the issues. Armed with this knowledge, farmers have the ability to devise methods to adapt to the changing climate and participate in mitigating the global warming effect. A reduction in GHG emissions is expected to occur for a number of reasons which include:

- reduced acreages of summerfallow (less soil is left bare during the growing season),
- reduced soil tillage with resultant increases in soil organic matter (soil organic matter is a "sink" for carbon dioxide),
- less fossil fuel usage for field operations,
- increased acreage of perennial forage crops, and
- increased efficiency of fertiliser usage and livestock feeding, increased photosynthetic rates, and increased usage of renewable fuels such as ethanol.

Extension Service SAF continues to be involved in on-farm energy management and efficient use of resources for the crop and livestock production. Noteworthy efforts in which Extension has been involved include widespread use of communication and incentive programs (Appendix B).

Clear objectives must be established for the future. The following goals are attainable:

1. Doubling of conservation tillage practices by 2010.
2. Decrease in the summerfallow area by another 25%.
3. Reduce fertiliser use by 10% of the base level.
4. Improve fuel use efficiency of farm machines by 10%.

5. Improve efficiency of manure handling systems.
6. Improve the rumen efficiency of farm animals.
7. Increase in red meats production (50% increase in beef cattle and doubling of hogs) by 2010.

Conventional measures, such as improving fuel efficiency, manure handling systems, and rumen efficiency may help but only marginally. Herein lies the challenge facing the agriculture industry: if it has to participate in lowering its emissions of greenhouse gases, more innovative solutions must be devised. Furthermore, adoption of some of these measures may affect the farmers adversely. If such is the case, what incentives are there for farmers to adopt such measures. The global community must address these issues prior to embarking on imposing sanctions for reducing agricultural emissions

SAF Extension Branch is involved in information generation and dissemination to early adopters. This includes involvement in on farm demonstration programs plus data collection. SAF funds numerous research and extension programs through the Agriculture Development Fund. A comprehensive direct seeding guide has been developed to meet specific information needs (Saskatchewan Soil Conservation Association, 1999).

SAF Extension Service will continue disseminating information to producers. Workshops are planned to promote discussion and encourage innovations that would meet GHG emissions reduction objectives set for the industry. In addition, a vast array of information technologies are available to present the message.

4.3.2 Centre for Studies in Agriculture, Law and Environment (CSALE)

Part of CSALE's objectives is to provide a forum for public discussion and debate for issues of concern and controversy. The centre tries to nurture this by having different methods of communication with the diverse segments of the agriculture community. CSALE produces printed material in many forms: Occasional Papers, Working Papers, a newsletter, an annual report, and many reports of collaborative work. The Centre has a website where the published material is available for downloading. There is face-to-face communication in the forms of a Seminar series, outreach workshops, and conferences. CSALE Directors, staff, and representatives are available for media interviews and speaking engagements and also serve on committees relevant to the areas of study focus.

The research areas of focus for the Centre include: 1) sustainable agriculture, 2) trade and the environment, and 3) institutional reform. Research into GHG issues falls neatly into these three categories. The impacts of climate change will constitute change in these areas. CSALE and CAEEDAC have many projects underway which relate to climate change, including comparison of energy use in different cropping systems, conversion of marginal land to permanent cover, the economics of agroforestry, revegetation of coal strip mines, and cogeneration of energy through biodigestion of hog manure, to name the most recent.

CSALE, CAEEDAC, and the Saskatchewan Land Resource Centre (SLRC) have initiated the Agriculture Climate Change Network (ACCN). The Network will facilitate the coordination of climate change research in agriculture across Canada. The members of these Centres are involved in all aspects of GHG research in agriculture from the basic, field-based measurement of gases through to regional and national levels of modeling. The Network will lead in the coordination of scientific research and the development of policies to reduce net emissions of GHGs from agriculture and related activities. There is a strong need for the integration of research in this area. The ACCN will provide the coordination and also act as the bridge between the field research database and the modeling aspect of analysis for the integration of policy making.

A series of workshops is planned over the next two years in smaller centres over the province of Saskatchewan in order to address the Agriculture and Agri-Food Issues Table Options Paper's Recommendation 1:
Governments should province resources to assist the extension of knowledge required to foster the adoption of proven technologies. For example, governments should work with the industry to encourage the adoption of

improved grazing management systems, feeding strategies, and zero-tillage cropping systems (Agriculture and Agri-Food Canada, 2000).
The three centres have developed an on-site extension program which will provide two-way communication and field demonstration opportunities for farmers to observe and discuss GHG issues and reduction strategies with the foremost researchers in the area of GHG emissions reduction in Saskatchewan. The program has the potential to reach over 50,000 farmers. It can be used also as a model for other provinces, e.g., Alberta and Manitoba.

4.1.3 Canadian Agriculture Energy End-use Data Analysis Centre (CAEEDAC)

The Canadian Agricultural Energy End-use Data Analysis Centre (CAEEDAC) is one of five national centres looking at energy use in different sectors in Canada funded by Natural Resources Canada (NRCan). CAEEDAC was established in 1994 in the Department of Agricultural Economics, University of Saskatchewan. The other Centres are also located at universities across Canada and include the automobile, industry, commercial, and residential sectors.

The main work of the Centre includes collecting data and maintaining a database on energy use in agriculture from provincial, federal, and other agencies. These data are accessible through CAEEDAC's Home Page on the Internet and the Centre provides a bibliographical publication of pertinent literature. Other work includes cross-tabulation of Census data and data collected through surveys on agricultural energy use. Included are Census data from 1991 and 1996 and survey data from 1981 and 1997. Another activity consists of integrating the Energy Efficiency Trends in agriculture into the NRCan publication of energy efficiency in the sectors covered by the different Centres across Canada (Appendix A). Energy use trends in agriculture show an increase in CO_2 emissions over the last decade, especially emissions from the use of diesel fuel (Lindenbach et al., 1999).

Although CAEEDAC does not have its own specific extension programs, CAEEDAC does produce its own publications and website. The close relationship with CSALE means that much of the work of both Centres is collaborative in nature and information is available through the efforts of both. One of CAEEDAC's projects was to develop a CD-ROM (Farm Energy Manager) which can be used by farmers to assess their own on-farm energy use and compare it to regional and national averages. Further development of this type of interaction could enable farmers to consider the effect of different management options that could incorporate information that goes well beyond changes in energy usage. The farmer could determine which overall farming practice would be efficient for their operation - both in terms of the economics but also GHG emissions reduction.

For example, a concept referred to as "Gear Up - Throttle Down" (GUTD) relates to the fact that an engine operated under maximum or near maximum load achieves the greatest amount of work per given volume of fuel. But many field operations do not require maximum rated horsepower. A farmer can save fuel in these operations by shifting to a higher gear and slowing engine rpms to maintain the desired field speed. Data from the Prairie Agriculture Machinery Institute (PAMI) indicates that a large diesel tractor working at reduced engine speed for a light drawbar load can use less fuel than a smaller tractor working at rated capacity. A 1983 University of Saskatchewan study of 16 tractors under a range of loads showed overall fuel consumption reductions averaged 9 to 18 per cent in GUTD mode. Even if GUTD is used only one-third of the time, savings can be substantial.

5.0 CONCLUSION

In the agriculture industry, stakeholders are many as it is a multi-faceted sector of the economy. Responsibility to reduce GHG emissions rests not solely on the shoulders of the primary food producers but on an extensive group including other industry sectors. To monitor and verify GHG emissions in agriculture means a concerted effort to study at an interdisciplinary level and to coordinate research on a national basis. In any case, the benefit to society will arrive only with the adoption of GHG emission reducing strategies and adaptation at the farm level. So, it is important that all stakeholders communicate accurate and concise information with each other and that communication is kept two-way.

Achieving understanding of GHG emissions in agriculture is only the beginning. The farmers who will be ultimately obligated to invest in GHG emission reductions on their operations need to have access to information not only on how these strategies will benefit society but on how to make efficient use of technologies to benefit themselves. ❑

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APPENDIX A

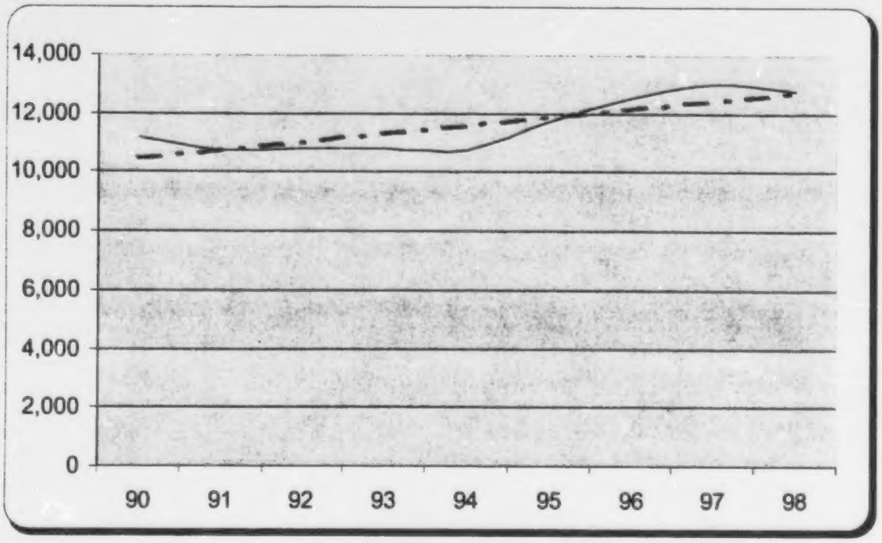


FIGURE 1: Agricultural CO_2 Emissions 1990 - 1998 (000's tonnes of CO_2)

(broken orange line is trend line)

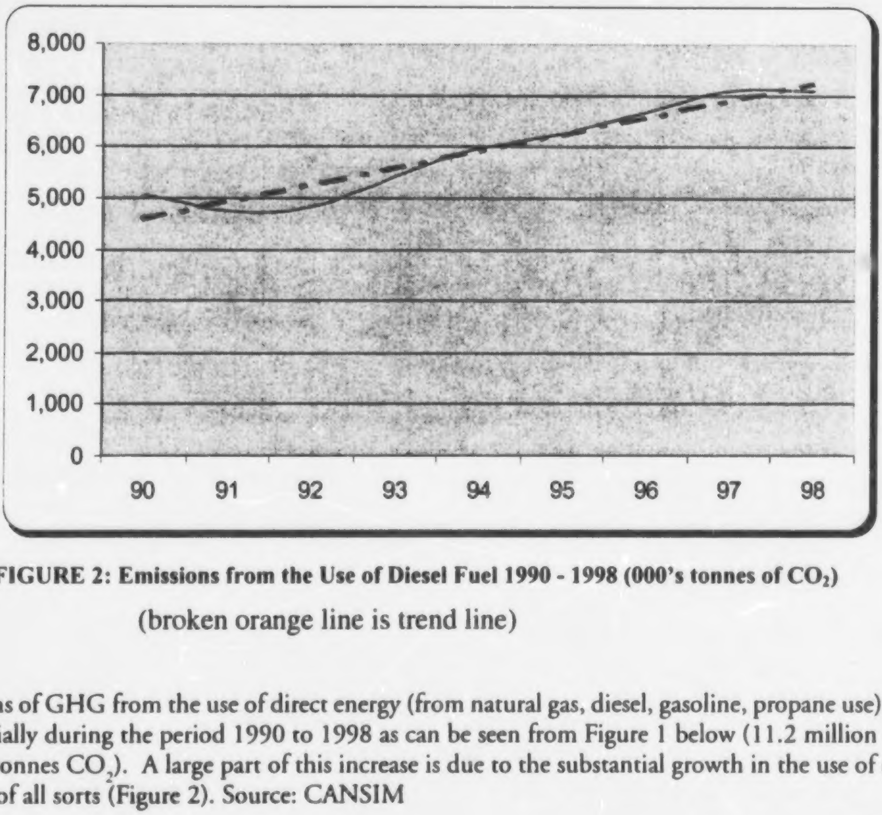


FIGURE 2: Emissions from the Use of Diesel Fuel 1990 - 1998 (000's tonnes of CO_2)

(broken orange line is trend line)

Emissions of GHG from the use of direct energy (from natural gas, diesel, gasoline, propane use) have increased substantially during the period 1990 to 1998 as can be seen from Figure 1 below (11.2 million tonnes to 12.8 million tonnes CO_2). A large part of this increase is due to the substantial growth in the use of diesel-powered vehicles of all sorts (Figure 2). Source: CANSIM

APPENDIX B

Some Efforts of Extension Services Branch of Saskatchewan Agriculture and Food

On-farm demonstrations for continuous cropping using direct seeding systems
Reduction of summerfallow
Chem fallow with reduced tillage
Manure management/injection for efficient utilisation
Organic production reduced pesticide use
Grasslands and pasture technology program to encourage forage production
Permanent cover programs
Legumes in rotation reducing dependence on nitrogen fertilisers
Expanding livestock production
Straight cutting resulting in fuel savings
Energy use monitoring programs on the farm
Development of alternative energy sources for the farm such as canola oil as substitute for diesel fuel
Natural air grain drying systems reduced dependence on fossil fuels
Precision farming development of techniques to minimize over application of fertilisers and pesticides
Extension is involved in forest development and establishment projects
Residue management and reduced straw burning, fibre processing projects

How is Climate Change Relevant to Farmers?

B. Smit, E. Harvey and C. Smithers

This paper shows that climate change is perceived by farmers as being unimportant for Canadian agriculture. The paper illustrates ways in which the agri-food sector is sensitive to climate change, and notes some opportunities for improving communications about climate change and agriculture. Three central questions are raised. First, do studies that focus on changes in average temperature over several decades capture the pertinent conditions with which farmers will have to deal? Second, are discussions of crop yield and production impacts the best way to understand the potential implications of climate change for agriculture and for farmers? Third, is it reasonable to assume that agriculture will efficiently and effectively adapt to changes in climate?

INTRODUCTION

For most people in the Canadian agri-food sector, global climate change is a non-issue. Farmers, agronomists, agricultural researchers, advisory officers, and representatives of producer organizations and government agri-food agencies tend to view global climate change (or "global warming" as it is more commonly called) as a topic that does not have significant implications for them. This view may seem surprising given the degree to which agricultural production is dependent upon climate and weather conditions, and given the importance of agriculture in global assessments of climate change impacts. An understanding of this perception and insights into the ways in which climate change is relevant to farmers represent necessary inputs to effective communications on climate change.

This paper outlines reasons for the perception that climate change is unimportant for Canadian agriculture, illustrates ways in which the agri-food sector is sensitive to climate change, and notes some opportunities for improving communication about climate change and agriculture.

PERCEPTIONS OF CLIMATE CHANGE IN THE AGRI-FOOD SECTOR

Agriculture is one of the most widely studied sectors in the international literature on impacts of climate change (Mimura 1999; Koshida and Avis 1997; Smith *et al.* 1996; IPCC 1995; Smit 1994). This is to be expected given the fundamental importance of food production to human well being and the widely-acknowledged importance of climatic conditions for agricultural production (Chiotti *et al.* 1997; Chiotti and Johnston 1995; Kaiser *et al.* 1993; Postel 1986). The United Nations Framework Convention on Climate Change (UNFCCC) explicitly notes threats to "food production" as a key concern underlying the commitments to act on climate change (UNFCCC; Smit *et al.* 2000). Within Canada also, there has been considerable research on the potential impacts of global climate change for agriculture (Bryant *et al.* 2000; Brklacich *et al.* 1997; Bryant *et al.* 1997; Chiotti *et al.* 1997; Smit *et al.* 1997; Arthur and Van Kooten 1992; Brklacich and Smit 1992).

Yet, among farmers and other stakeholders in the agri-food sector climate change is rarely an issue of great importance (Chiotti *et* al. 1997; Holloway and Ilbery 1997; 1996). For example, most informants in a study of Southern Alberta farmers identified societal forces as the greatest challenges experienced over the previous decade. Climate, including references to drought, which had been widely experienced in the previous decade, was rarely mentioned. The major challenges that the same group of farmers expected to face in the coming decade included mainly issues of agricultural restructuring (Chiotti *et al.* 1997). Other studies of farmers in the UK indicate that global warming, while defined by informants as a key environmental issue, is not one that many of them feel will have negative implications for them (Holloway and Ilbery 1996). Farmer organizations and producer groups frequently identify issues of concern to farmers, and climate change is seldom mentioned. Sample surveys of farmers, including studies focussing on perceptions of climate change and its impacts show that farmers have considerable scepticism about climate change, and that even among those who accept that climate change is a legitimate issue, it is not considered something that they should worry about or do anything about (Bryant *et al.* 2000; Smit *et al.* 1996). There is evidence that farmers accept inclement weather, and the risks associated with it, as a cost of doing business (Chiotti *et al.* 1997; Carlisle 1988).

For many agricultural organizations and government agencies, the important part of climate change for agriculture is twofold. First is the perceived opportunity to somehow benefit from agricultural carbon sequestration and hence carbon credits and second, the need to reduce greenhouse gas emissions in agriculture as a strategy to mitigate climate change. Even in the recent report of the Agricultural Table, as part of Canada's National Implementation Strategy on Climate Change, agricultural options included issues of greenhouse gas emissions and carbon sequestration, but did not consider at all the risks to agricultural production or agricultural producers associated with climate change (National Climate Change Process 2000).

There are numerous reasons why climate change has not attracted the attention of the agricultural community, including the relatively long time horizon involved in climate change and the need to deal with non-climate stresses, which are pressing and immediate. However, the insignificance of climate change in the agri-food community also relates to the way in which the climate change issue has been communicated. We identify three inter-related features of climate change impacts research and information dissemination that help explain the prevailing perceptions and which are important for future communications with stakeholders. These are:

- the characterization of climate change
- the focus of agricultural impacts research
- assumptions about agricultural adaptation

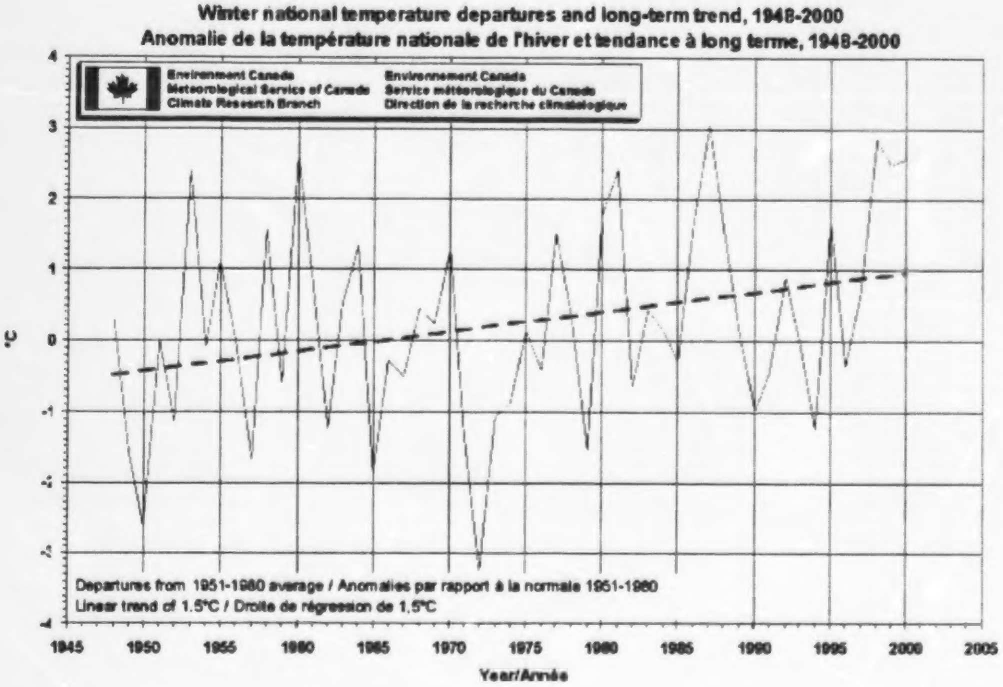
HOW IS CLIMATE CHANGE CHARACTERIZED?

Most communications about global climate change (and its regional manifestations) focus on changes in *average* temperature over several decades. Climate change scenarios generate information mainly dealing with average temperatures, although, it has recently become more common to include precipitation (*e.g.* Segerson and Dixon 1999). Climate change impact studies in agriculture, both in Canada and internationally, have generally been based on comparisons of current average temperature with possible future average temperature (Brklacich *et al. 1997;* Baethgen and Magrin 1995; Curry *et al.* 1995; Brklacich and Smit 1992; Brklacich *et al.* 1991; Smit *et al.* 1989). Thus, the message from the scientific community is that climate change is essentially about a one or two degree change in average temperature ("norms") over the next two or three decades. Climate change is most commonly referred to as "global warming" because of this emphasis given to changes in average temperature.

The agricultural community does not get excited about such predictions or scenarios. Quite apart from issues of uncertainty or whether there is "proof" yet of global warming, a one or two degree change is considered essentially irrelevant for agricultural producers, because they deal with much greater temperature variations than this, from day to day and week to week within growing seasons, and from year to year. The climate conditions that are pertinent to the agri-food sector are inherently variable. Figure 1 illustrates one type of variation, the inter-annual variability in temperature. From a temperature point of view, the "norm" rarely occurs, and farmers are used to dealing with variations from year to year.

It is widely accepted that agriculture in a particular region is generally well adapted to "normal" (i.e. mean or average) growing season conditions for that region, but is susceptible to anomalous or extreme conditions. Assuming slow and monotonic change in climate, and assuming the farm community (breeders, agencies, companies, producers) are aware of (and plan for) such changes, agriculture should maintain its adaptation to

FIGURE 1. Canadian Climate Temperature Trends



Source: Environment Canada 2000

mean conditions. Changes in mean annual temperature of one or two degrees (C) are rarely considered problematic in agriculture.

The temperature conditions that matter for agriculture are the extremes, or those conditions beyond a "coping range". The coping range refers to the range of conditions within which a system can continue to be viable (Smit *et al.* 2000; Smit 1994). The changes in "norms" anticipated in most climate change scenarios usually fall within an existing coping range, and are therefore not considered to be particularly problematic. So long as climate change is characterized exclusively or primarily in terms of average temperature (or "norms") over periods of decades, it will remain a non-issue among agricultural stakeholders.

However, just as agriculture is sensitive to temporal variability in climate now, so too will it be under conditions of climate change and perhaps significantly more so. If climate change involves a change in mean conditions, it must necessarily also involve a change in the frequency and/or magnitude of some extremes (Hengeveld 2000; Smit *et al.* 2000). The frequency of extreme events outside a given coping range can be greatly changed with very small changes in the value of the mean. A problematic condition (e.g. severe drought) which currently has a probability of occurring once every 30 years, may become a once in four or five year event. In a more extreme example, it has been suggested that extreme events could increase by a factor of 25 with a 1.5 degree increase in average temperature, making a one in one hundred year event become a one in four year event (Francis and Hengeveld 1998). While changes in long-term mean climate may not greatly interest farmers, risks associated with probabilities of extremes are certainly of interest.

Just as climate change is not simply about long-term averages, it is also not just about temperature. Studies of the sensitivity of agricultural systems to climate indicate that temperature is only one of many attributes to which farmers are sensitive. Other variables include moisture (especially extreme in the form of droughts, dry spells, floods), rainfall intensity, growing season length, timing and severity of frosts, sunlight, wind, and climate related variables including pests, insects and plant diseases (Downing *et al.* 1999; Schimmelpgennig *et al.* 1996; Smit *et al.* 1996; Hengeveld 1995). One of Canada's State of the Environment Reports on atmospheric change suggests that with all other climate conditions remaining equal, warmer temperatures would generally be good for Canada's agriculture but that the likelihood of other variables remaining constant is highly unlikely (Hengeveld 1995). The particular climate attributes vary in importance across regions and farming types. It is clear, however, that while agriculture may not be sensitive to long-term changes in average temperature, it is indeed sensitive to the occurrence, frequency, magnitude and return period of conditions which deviate from average – and these are part of climate change.

STUDIES OF CLIMATE CHANGE IMPACTS IN AGRICULTURE

Most agricultural impact studies (in Canada and elsewhere) not only focus on *average* climate conditions but also focus on plant growth and yields, with little attention given to economic decision making and risk management strategies. Even studies of farmers' perceptions of the impacts of climate change tend to focus on production related impacts (Holloway and Ilbery 1997). Climate change impacts are generally seen primarily as a biophysical issue and results are reported that particular changes in average conditions will increase or decrease yield by a certain percent (Brklacich *et al.* 1997; Brklacich and Smit 1992; Smit *et al.* 1988). The communication of climate change implications for farmers in terms of purely biophysical conditions does not reflect the reality of a farmer's situation because farmers are ultimately affected not so much by production stimuli as by the economic and social ramifications of production changes and farmers rarely respond to a particular stimulus or condition in isolation

Farmers are keenly aware of the economic consequences of extremes such as droughts, especially if they recur or if their probability of occurrence (and hence risk) changes. These economic consequences are not simply a derivative of production levels, nor are they experienced only by the farm community. Droughts, for example, have economic consequences for farmers that are moderated by crop insurance and by established and *ad hoc* government programs. Climatic variations matter for the agricultural community because they have implications for incomes, farm family security, rural communities, local economies, insurance premiums, and aid packages.

The economic and social relevance is clearly evident in media reports of the farm sector being affected by climate and weather events. Newspaper articles site a range of consequences of inclement weather including, of course, crop failure, reduced crop quality and changes in crop preparation and production scheduling, but also indirect impacts such as income loss, market volatility, customer loss, increased imports and costs in the affected area, implementation and use of relief and safety net programs, closure of local services, emigration and in more extreme international examples, famine and riots.

So long as studies of agricultural impacts of climate change are reported in terms of yields and physical production changes associated with average conditions, they will have limited receptivity in farming communities. Not only does climate change become more pertinent for agriculturists when it is expressed in terms of probabilities of extremes, but also it is of wider interest when these probabilities and risks are described in economic and social terms. Climatic change becomes more relevant to farmers when it is shown to bring risks to incomes, costs of insurance, or the viability of government support programs.

ADAPTATION IN AGRICULTURE

When confronted with information about climate change and about its potential impacts for agriculture, a widespread response in the agricultural community is "we will adapt". This view is well founded because, by their very nature, agricultural systems must continually adapt to environmental, technological and political conditions to survive. The fact that practices employed, and crops grown, in the climate of Southern Ontario differ from those in Northern Ontario illustrates adaptation to spatial differences in climatic regimes.

Studies of climate change impacts increasingly recognize the potential of adaptation to minimize detrimental effects and to realize opportunities associated with climate change. Long lists of possible adaptive measures have been prepared (e.g. Smit 1994), ranging from crop breeding, through tillage practices and enterprise selection, to insurance and financial management of climate-related risks. Studies of agricultural decision-making over time show that farmers employ a variety of short-term (tactical) and longer-term (strategic) to deal with climatic variations (Smithers 1998; Smithers and Smit 1997; Easterling 1996; Reibsame 1991).

In the case of wet weather, as an example, a farmer may choose to implement one or a combination of several short-term strategies to mitigate the risk of the 'abnormal' weather conditions. Some of these strategies include changing crops or replanting. Longer term, tactical responses might include changing, the crop, the variety, the rotation of the crop or the planting schedule (Smithers, 1998). This past May provides a valuable example of the strategies that farmers use to respond to weather that deviates from normal. Corn producers in Southern Ontario were concerned about not having a long enough dry period in May to plant their corn crops and considered planting soy crops as an alternative that would allow them to plant their crops later, when the particularly wet weather ceased (Daynard, 2000).

Modelling studies of the impacts of climate change show that, without adaptation, agricultural production is vulnerable even to changes in long-term mean conditions. However, once these studies assume that farmers know the climate they receive and adapt accordingly then climate change is not problematic for agriculture. If full information and adaptability are assumed, as is the case with more recent modelling studies, there are even production increases with climate change (Helms *et al.*, 1996). The models of Rosenzweig and Parry (1994) show that, with adaptations assumed, food production could be increased under climate change in many regions of the world. Downing (1991) demonstrates the potential of adaptations to reduce food deficits in Africa from 50% to 20%. Mendelsohn and Dinar (1999), estimate that private adaptation could reduce potential climate damages in India's agriculture from 25% to 15-23%. Reilly *et al.* (1994) estimated global "welfare" losses in the agri-food sector of between $0.1 billion and $61.2 billion without adaptation, compared to +$70 to - $37 billion with adaptation assumed. These studies indicate the **potential** (rather than the **likelihood**) of adaptation to alleviate damages (or benefit from opportunities) associated with changes in climatic mean conditions.

However, farmers do not get precisely average climate each year, nor are they able to predict exactly the growing season conditions each year, nor do they employ all of the types of adaptations assumed in the modelling studies. In reality, agriculture is vulnerable to even current variability (and uncertainty) in climate. This limited adaptability of Canadian agriculture to climatic variations over time is evident in the widespread and recurring losses associated with climatic conditions.

Comprehensive data on climate-related income losses in Canadian agriculture are not available. However, the media regularly reports on weather conditions that are different from average or normal and that present challenges to farmers in terms of their ability to cope. As illustrated in Table 1, weather conditions, which represent variability about climatic norms, frequently represent losses in the millions of dollars for farmers. These losses indicate the economic vulnerability of Canadian agriculture to climatic variability. Given these losses, questions arise as to the effectiveness of existing adaptability to climatic variations, and hence to variations and extremes that are likely to be associated with climate changes.

A major component of agriculture's coping mechanism, given the losses indicated above, is government (tax payer) subsidy and relief – via federal and provincial income support programs such as NISA and AIDA, ad hoc relief programs, crop insurance and the Disaster Financial Assistance program. Government supports crop insurance by covering the administrative expenses of the program, subsidizing farmers' premiums up to 80% in some provinces, and by incurring any and all losses that the program experiences as a result of claims surpassing collected premiums. There is ample evidence that farmers rely on such programs to mitigate the losses associated with adverse weather. In the period since 1970, an average of over $300 million per year was paid out to farmers

TABLE 1. Examples of Weather Conditions resulting in Losses in Agriculture

Year	Region	Condition	Losses in agriculture	Nature of Losses	Source
1999	Nova Scotia	drought	$35 million	ruined crops	Halifax Chronicle Herald 09/14/99
1999	Maritimes	drought	$30-$50 million	damage estimates (crop losses and livestock sales)	Halifax Chronicle Herald 06/14/99
1998	Southern Manitoba	flood	$164 million	provincial payments for claims, repairs and reinvestment (not solely agricultural losses)	Financial Post 04/02/98
1992	Southern Alberta	snowstorm and frost	$120 million	crop insurance claims	Financial Post 12/28-31/92
1997-1999	Northeastern Alberta	droughts and floods	$220 million	disaster relief (some of which was to support low commodity prices)	Edmonton Sun 10/13/99

in the form of crop insurance premium support, crop insurance indemnities and ad hoc relief programs by governments (federal and provincial) because of losses associated with adverse weather conditions. Studies have also shown that farmers tend to make more use of crop insurance programs following poor years (Smithers 1998; Smit 1994). Hence, an important part of agriculture's adaptation to variations in climate involves relying on government support.

There are several issues, associated with this reliance on government support as a strategy to manage weather conditions that deviate from 'normal'. There is evidence that the existence of government subsidies and ad hoc relief discourages autonomous adaptations in farming systems to climate variability (Smithers 1998; Chagnon 1997; Smit 1994; Lewandrowski and Brazee 1993). There is less incentive to adopt individual risk management strategies when government safety net programs serve that purpose.

However, governments are becoming less willing to provide this kind of support because of public opinions regarding subsidies and because of international trade agreements, which preclude many forms of government support. The agri-food sector is faced with the prospect of a reduced role of government in providing economic resources for the management of climate-related risks, at a time when there may be increases in the frequency and magnitude of climate extremes with which farmers will have to cope.

Certainly, agriculture has adaptive options, but they are far from sufficient to deal with the risks associated with climate change. Canadian agriculture remains vulnerable to climatic variations from year to year. The extremes may become more problematic, and government support is not likely to increase.

CONCLUSIONS

In order for the farming community to take the issue of climate change seriously there needs to be a shift in the way the issue is communicated. We have identified three areas in which communication could be improved to show the relevance of climate change to farmers and the agri-food sector. First, it is necessary to show that climate change is not just about mean temperature several decades away but rather involves changes (probably already being experienced) in probabilities (risks) associated with variability. Second, the implications of climate change (including variability) need to be shown to involve risks to income, local economies, and overall family and community well being and not just crop yields. Finally, the assumption that agriculture will efficiently and effectively adapt and the associated apathetic and reactive responses to climate change by policy makers and agriculturists need to be altered. ❑

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Session F4

PANEL DISCUSSION: DEVELOPMENT OF AN INTERNATIONAL CLIMATE CHANGE COMMUNICATION NETWORK

Using a Knowledge Network Model for Research and Communications on Climate Change: The Experience of the International Institute for Sustainable Development
Heather Creech and Victoria Kellett
International Institute of Sustainable Development

Using a Knowledge Network Model for Research and Communications on Climate Change: The Experience of the International Institute for Sustainable Development

Heather Creech and Victoria Kellett

IISD presents its research and experimentation with knowledge networks, in particular the application of the knowledge network model to communications on climate change. The Climate Change Knowledge Network (CCKN) consists of 14 organizations in developed, developing, and countries in transition. The objectives, structure, operations and results of the CCKN are presented, together with broader perspectives on key elements for successful networks, including focused research agendas linked to decision maker interests, governance structures, internal and external communications strategies, simple evaluation techniques to measure the impact of the network, and the role of young professionals..

INTRODUCTION

One of the outcomes of the Climate Change Communications Conference is to foster an international climate change communications network. We hope that IISD's experience with creating a formal network in this field will catalyze important discussions and strategies at the Conference. We will explore how to set focused research agendas linked to decision maker interests, governance structures, internal and external communications strategies, and simple evaluation techniques to measure the impact of the network.

THE ORIGIN OF THE CLIMATE CHANGE KNOWLEDGE NETWORK

The Climate Change Knowledge Network (CCKN) was formed shortly after the third conference of the parties to the Framework Convention on Climate Change (COP3). It is a group of organizations from both developing and developed countries that work together on various policy and research issues related to climate change. The vision of the Network is an open, accessible, equitable, and high-quality global exchange of knowledge and research expertise on climate change related activities, which contributes to sustainable development in each of the major regions of the world.

In the context of this vision, the goal of the CCKN is to enhance the capacity of developing and developed countries to shape an effective, sustainable and equitable climate change regime. It does this by implementing capacity building projects and carrying out collaborative research on key climate change policy issues such as the Kyoto mechanisms, adaptation, and technology transfer. The spreadsheet appended to this paper shows the projects currently in the pipeline within the CCKN. In addition, the Network aims to increase discussion and understanding between industrialized and developing countries in an effort to promote a more proactive and constructive international negotiation process at the various UNFCCC meetings.

IISD'S EXPERIMENTATION WITH KNOWLEDGE NETWORKS

IISD has 4 years of research and experimentation with the knowledge network model of institutional collaboration:

- 1996: IISD established Spinning the Web, our prototype knowledge network, and other information networking experiments.
- 1997: Together with IDRC and the North South Institute, IISD sponsored the Strong Task Force Report on Canada's International Priorities for the 21st Century. This task force identified knowledge brokering as a key action area; and that efforts should be made to more effectively utilize ICTs (information and communications technologies) to support this priority.

- 1998: IISD commissioned a follow-up study on Canadian experience with formal knowledge networks, to come to a better understanding of what knowledge networks are and how they work.
- 1998-99: Based on our research and practical experience, we then established two more knowledge networks, in the areas of Trade and Climate Change.

We have currently three formal knowledge networks in operation: the Sustainable Development Communications Network (which grew out of the Spinning the Web project); the Trade Knowledge Network; and the Climate Change Knowledge Network. In total, we have over 80 organizations around the world involved as members and affiliates to our three networks.

While these networks each have their own research and communications agendas, we are also using them to fine tune and evaluate the knowledge network approach to sustainable development.

We have a working definition for a knowledge network:

> Knowledge networks consist of groups of expert institutions working together on a common concern, strengthening each others' research and communications capacity, sharing knowledge bases and developing solutions that are made available for use by others outside the network

Four key points are captured in this definition:

- Knowledge networks require institutional commitment, beyond the participation of individuals and experts.
- Institutional collaboration takes place around a single issue or problem rather than a broad spectrum of interests: focus and work plans are essential.
- Strengthening capacity is critical to this model: we create knowledge networks in order to learn from each other and build on each other's strengths.
- Knowledge networks must move beyond basic information exchange to actually working together on solutions. In other words, a knowledge network is more work than net.

HOW THE CCKN WAS FORMED

In the fall of 1997, IISD, IDRC and the North South Institute commissioned a scoping study on the demand and need for a knowledge network that would bring developing and developed country expertise together on climate change policy. As part of the study, interviews were conducted with dozens of key individuals and organizations.

The study was completed in February 1998. It found that there was considerable demand in developing countries for some sort of network on climate change policy, not only to facilitate communication and the exchange of knowledge between north and south, but also between different regions of the south.

IISD then developed a list of potential network member organizations based on the following principles:

1. the need for equal representation of the major regions of the world
2. the need for an equal number of northern and southern organizations
3. the organization should be recognized source of expertise on climate change policy
4. the organization should have well established regional and local networks and contacts

We convened representatives from about 16 organizations to attend a two-day scoping meeting in Ottawa in May 1998, to discuss the goal, objectives, membership, structure, and funding strategy for a network based on the scoping study. One of the key decisions was to take a two-pronged approach, focusing both on short-term research and knowledge generation, and on longer-term capacity building. Once we agreed on these basic elements, including on the list of members, IISD invested several months in developing a proposal with several rounds of review and input from network members.

In November 1998, we re-convened the member organizations at COP-4 in Buenos Aires to review the draft proposal and to develop a more detailed work program or research agenda, which was subsequently written into the CCKN proposal. Once the proposal was complete in January 1999, we stepped up our efforts to raise funds and cultivate support for the network.

In May 1999, the network members met again for two days in Oslo to flesh out concepts for the first round of collaborative projects to be undertaken by the CCKN. Nearly every member organization came prepared with ideas or even pre-drafted concept papers for projects on which they would be willing to take the lead. By the end of the meeting, we had identified 12 potential projects, a lead organization and potential partners for each one. This point marked the beginning of the real life of the network.

Finally, at COP-5 in November 1999, members signed the Network Agreement which had originally been discussed in Oslo in May, and subsequently drafted with input from the 14 member organizations.

STRUCTURE AND MEMBERSHIP OF THE CCKN

The Network Agreement describes the vision, goals and modus operandi of the CCKN. It lays out the roles and responsibilities of the various types of membership (core, associate, observer, donor's group), and the criteria for and benefits of membership in the Network. It also describes the role of the Network Coordination Unit. Finally, it outlines various decision-making processes within the network.

Core Members are select organizations from a range of developed and developing countries engaged in climate change policy research. Core members participate in the Network decision-making processes. Developed country core members assist with fundraising for the Network as a whole, and particularly for those activities in which the member is involved specifically. For developing country core members, the costs of participating in the Network may be covered by Network project grants as necessary.

Specific roles and responsibilities of Core Members include:

1. Developing and implementing research projects on climate change.
2. Fundraising for project proposals on climate change.
3. Coordinating specific areas of research among core members.
4. Engaging the participation of governments, the productive sector and civil society in Network activities and meetings.
5. Assigning staff to the work program of the Knowledge Network. The level of staffing will ultimately depend on resources obtained by the Network.
6. During Network meetings, organizing presentations, seminars and demonstration activities based on the progress and results achieved in their respective work program areas. The goal will be to bring other core members, non-core members and other participants in meetings "up to speed" on their work program theme area, and to leverage each other's learning experiences.
7. Disseminating the results of their work and demonstration activities directly to other members and via the NCU. Annual summaries of progress will be prepared by each core member, and posted on the Knowledge Network's Web site.
8. Where appropriate, delivering the results of the Network's work on their own Web sites, to be linked to the CCKN Web site.

Each major region is represented by at least one organization in the network. The 14 core members are:

- Centre for International Climate and Environment Research - Oslo (CICERO), Norway

- Center for Sustainable Development of the Americas (CSDA), U.S.A
- Federal University of Rio de Janeiro (COPPE), Brazil
- Energy Research Institute (ERI), China
- Environnement et developpement du tiers-monde (ENDA - Energie), Senegal
- Global Industrial and Social Progress Research Institute (GISPRI), Japan
- Instituto de Economia Energetica (IDEE), Bariloche Foundation, Argentina
- Institute for Environmental Studies (IVM), Netherlands
- University "Kiev-Mohyla Academy" (UKMA), Ukraine
- Southern Centre for Energy and Environment (SCEE), Zimbabwe
- Stockholm Environment Institute (SEI), Sweden
- Tata Energy Research Institute (TERI), India
- World Resources Institute (WRI), U.S.A.
- The three co-operating Canadian institutions working together as one member, i.e. the International Institute for Sustainable Development (IISD), the International Development Research Centre (IDRC), and the North-South Institute (NSI).

Associate Members include United Nations agencies and potentially other sustainable development organizations with an ongoing interest or work program related to climate change. These members will participate in the Network by maintaining linkages between their work and the work of the Network. They may choose to collaborate in specific projects where appropriate, and are expected to cover their own costs of participation. Current associate members are:

- UNFCCC
- UNDP
- UNCTAD

In addition, the CCKN may choose to invite an organization to be an **Observer Member**. Observer Members are organizations who are undertaking climate change activities that are relevant to the CCKN. They are able to attend CCKN meetings, can offer suggestions for projects, and will have access to the network members. As observers, they are not asked to participate directly in projects; however, sharing of relevant work is welcomed. Observers are asked to cover their own costs of participation.

The network is coordinated by a **"Network Coordination Unit"** within the International Institute for Sustainable Development (IISD). The role of the Network Coordination Unit is to assist members in developing, fundraising for, and implementing Network projects. The Network Coordination Unit also builds and maintains the Network's web site, facilitates communications, and organizes Network meetings.

HOW THE CCKN WORKS

The CCKN is a research and action-oriented network. It exists to capitalize on the synergies created when several diverse organizations communicate regularly and share experience and expertise. Network members take the initiative to develop collaborative projects (involving two or more member organizations), with assistance from the NCU where necessary. Over the past year, nine network projects have emerged, in various stages of the project cycle. The attached spreadsheet summarizes the status of the projects.

The Network meets at least once a year, although two meetings a year is preferable in terms of maintaining momentum. For maximum efficiency, we try to piggy-back on FCCC meetings. These network meeting are the primary forum for all members to review and discuss network projects, communications and fundraising strategies, the research agenda, and new priorities. In addition, they will be the focal point for key decisions such as changes to the membership or the Network Agreement.

Between meetings, CCKN members communicate via an electronic mailing list. IISD, as the Network Coordination Unit, is also developing a network website which will:

- provide a presence for the CCKN as an entity;
- serve as a depository for the network's working papers, workshop reports, articles, and other outputs;
- host an online information resource;
- eventually host an "extranet";
- contain administrative and supporting information; and
- provide links to members' web sites and other useful sites.

While the network is focused on substantive research and capacity building, in the early phase of the CCKN it was acknowledged that capacity in information technology and Internet communications was crucial to the operation of the network. The Network Coordination Unit conducted an information systems appraisal focusing on hardware, software, and technical know-how. Based on the results of this appraisal, certain members' capacity was upgraded through purchase of hardware and software and through staff training on Internet research and web site development. Information technology capacity will be reviewed each year for developing country members, in order to ensure optimal ability to participate in the network.

SPECIFIC LESSONS LEARNED FROM THE CCKN EXPERIENCE

- two-year investment was required to establish the network
- personal relationships are crucial, but buy-in is also needed from the institutions in the network as key contact people do leave
- networks need full-time coordination
- development of the network is more effective if it is carried out in a participatory manner
- communication with members needs to be regular, frequent, and open
- some members are more involved/committed than others
- interns play an important role in moving the work forward
- it is difficult to get funding for general network, easier for specific projects or events
- the network must have a work program/research agenda/solid goal – what difference will the network make? What value will it add?
- when people meet in person they get more done in 2 days than over 6 months by email.

BROADER LESSONS LEARNED FOR KNOWLEDGE NETWORKS: THE FIVE ELEMENTS FOR SUCCESS

Although knowledge networks may vary widely in their scope, objectives and memberships, we believe that all of them must include the following five elements in order to be successful.

- Focus
- Structure
- Communications
- Evaluation techniques
- Youth participation

1. Focus

Each network must focus on a central issue or concern, rather than a broad spectrum of subjects. A research agenda should be established to guide the work of the organizations in the network. Research projects within that agenda should attempt to innovate, to break new ground. The network must look for new ideas and approaches; it must move beyond the traditional information exchange; the network must be prepared to take risks.

It is essential, we believe, that a knowledge network be designed to have influence and impact. Research alone is not enough; nor is the release of series of print and electronic publications. We believe that to be successful, a knowledge network must be linked to specific decision making processes: there has to be a clearly identified outlet for the research findings and recommendations. This focus on influence and impact is as important as the substantive research focus of the network.

2. Structure

Knowledge networks need structure and discipline to be effective and influential. The selection of partner organizations to join the network is an absolutely critical part of the process. Each organization has to have more than just an interest in the topic; it has to have real "bench strength" to do quality research on the issue. Each organization has to have a proven capacity to influence the policy process. Remember that these are not information exchanges, these are working networks with goals and objectives.

Cross fertilization of ideas is stronger when the network includes private sector as well as civil society groups; government as well as academic. The multisectoral composition of a knowledge network can lead to real innovation and practical implementation of policies and solutions.

A formal, signed governance agreement underpins the operation of the network: the agreement outlines duties and responsibilities of members, and the mechanisms for decision making. It is often necessary to mandate one organization to be responsible for coordinating and monitoring research agendas and communications strategies for the network. This coordinating body is often referred to as the Secretariat or Network Coordination Unit.

3. Communications

Knowledge networks require good internal and external communications strategies, to support the work of the network and to ensure that the results are effectively disseminated.

Traditionally, there are two types of "communications" strategies: public relations strategies which are focused on raising or managing a positive profile for an organization or corporation; and marketing strategies which "sell" a

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Climate Change Knowledge Network: Project Status Report

Projects by Partner

Member Organization	CICERO	CORPE	CSDA	ENDA	ERI	GISPRI	IDEE/FB	IISD	IVM	UKMA	SCEE	SEI	TERI	WRI
Name of Project:														
Benefit Sharing in the CDM	partner						lead							
CDM Design Project			partner											lead
Climate Change and Economic Changes in India: Impacts on Agriculture	lead							partner					partner	
Climate Change Capacity Project–Africa				partner				lead						
Climate Compendium								lead						
Decentralized Renewable Energy in Rural Areas of Developing Countries			partner						lead				partner	
Developing Country Baselines			partner				partner							lead
Economies in Transition as CDM Investors										lead				

particular concept or product. Marketing strategies fall into two camps: traditional business marketing approaches which require an analysis of customer needs, behaviour and media habits; and social marketing approaches which focus on behaviour change rather than sales, but which still require analysis of target audience behaviour and media habits.

The difficulty with the traditional PR, marketing and social marketing approaches is that they tend to be focused on, and work best for, single organizations, single products and single issues. But as we all know, sustainable development is built on the cooperation of multiple stakeholders, partners, and alliances, and the intersection of multiple considerations within the spheres of economy, environment and social well being.

Within the climate change community, we all need to expand our views of "communications" in response to:

- The complexity of the issues
- The number of groups working both independently and collaboratively on the issues
- The increase in availability of tools to support collaboration
- The speed and penetration of today's media vehicles
- The changing concept of "audience" from passive recipients of products to stakeholders and partners in problem solving.

A communications strategy for a knowledge network must therefore address both:

- internal communications – facilitating the interaction amongst the collaborators on a given piece of work, who are also often the direct beneficiaries of that work; including developing the hardware and software infrastructure and protocols required to support the joint work of the network: meetings and workshops, email, closed computer conferencing amongst members, Internet video conferencing, "extranets"; and
- external communications – the means by which both progress on the research agenda and the results of that work are shared more broadly, to decision making processes and to wider audiences: network website, print and electronic publishing, open computer conferences to discuss work with broader audiences; strategies for flowing the research results and recommendations into other media (print, radio, TV interviews, etc.).

Four principal concepts in network communications should be kept in mind:

- direct engagement of audiences as stakeholders, partners, and strategic allies in the work being undertaken.
- integrated use of media vehicles to reach out to and engage the target and broader audiences (media vehicles include electronic and in person conferences, email, the Web, broadcast, print, using the vehicles of others such as newspapers; using one's own vehicles such as reports, in-house journals)
- evaluation of the impact of the communications strategy – looking at outcomes in addition to outputs.
- Revisiting and refining the communications strategy over time – what may be working well one year may not be working the next.

4. Evaluation techniques for the network as a whole

We suspect that pooling our knowledge and staff resources in a knowledge network may be a more cost effective approach to research, particularly when adequately supported by good use of information and communications technologies. Clark's study of the National Centres of Excellence and other Canadian networks comments specifically on the financial health of many of the formal networks. The success of knowledge networks will also be measured by the quality of work on the research agenda, their influence on decision making processes, their operational performance (success in strengthening the capacity of partner organizations in research and communications), and the results of their communications strategies.

5. Youth participation

Finally, we have learned that effective networks also have roles for young professionals – graduate students, interns, and young employees. There are three key reasons for including young professionals in networks: to support and strengthen the substantive research of the network, to strengthen network processes and interactions of members, and to bring their ICT skills to strengthen communications. The gains to the young professionals themselves are also significant: their own research skills and understanding of the work will be improved, as will their project management and communications skills. ❑

Session G1

COMMUNICATION OF NATURAL VARIABILITY AND EXTREMES

Commune Linga Concordiam Parit: Building the Common Language of Risk
Kate White
Black & White Communications Inc.

The Value of Understanding Natural Climate Variability and Its Impacts as a Bridge to Thinking About Climate Change
Barbara Morehouse
University of Arizona

Bringing Climate into the Daily Weather Broadcast
Lucy Warner
University Corporation for Atmospheric Research

Commune Linga Concordiam Parit: Building the Common Language of Risk

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Kate White

ABSTRACT

A region may have no existence outside the consciousness of geographers, 'who, by their eloquence are able to create place.' Language can create place, can locate safety. Defining a place of safety, is in fact an act of building social cohesion.

As a society, we must find the appropriate language with which to inform and protect citizens from disasters while reducing their effects. At risk, with language that is unclear or ambiguous, is both immediate harm to citizens, the environment and the economy. Continuing to build separately, in different sectors, specialized language will only reinforce misunderstanding and ultimately, apathy. When we cannot understand the language intended to inform us, it is unlikely that we will act. Lack of commonality in language can also have the effect of erosion of confidence in governments and officials. In times of lower trust in institutions, the public reacts to language which seems to obscure instead of inform. Ultimately, the cost is reduced social cohesion at the local and even national level: a significant impact to any society compounding the already high "hard" costs of disasters. Lessons learned from recent disasters in Canada have shown that different communities believe in the authority of different "officials". This can cause some real confusion when immediate action is necessary. Attending to the language we use in conveying risk and disaster information is part of risk management. It is also a confidence building measure for disaster managers and communities at risk. The language of risk this paper examines includes risks from and to human health and the environment.

While "watches" and "warnings", "mitigation" and "preparedness" is the language of the disaster management community, it is not clear to the wider community. While command and control may be understood as essential to a cogent disaster response, in a democracy, citizens deserve to be informed of the expectations of them in disaster, in language which engages them in the process; language they understand, from voices they trust.

As science makes the link between climate change and the increase in extreme weather events, it is clear that at the science and policy levels, as well as at the grass roots, we must develop a lingua franca of risk. There is a nexus between the "expert" and "lay" sphere on issues of risk that needs to be bridged in a way that does not diminish the real concerns on both sides.

For effective disaster and risk communication in Canada, resources and commitment to a common language is essential. This must involve research during and post disaster as integral to evaluative studies of response. It also demands more intensive citizen engagement in the public dialogue about disaster and risk. Language, whether performative or descriptive can unite us in confronting challenges now. ❑

The Value of Understanding Natural Climate Variability and Its Impacts as a Bridge to Thinking About Climate Change

Barbara Morehouse

CLIMAS (Climate Assessment for the Southwest), a NOAA-funded regional assessment project, seeks to develop a better understanding of the impacts of climate variability on human and natural systems in the U.S. Southwest. The goal is to use knowledge generated through research in the natural and social sciences to improve the delivery of climate information services to stakeholders in the region. While the project's primary focus is on climate and its impacts at the seasonal, interannual and interdecadal time scales, the process of developing and communicating such knowledge to stakeholders provides a valuable foundation for engaging in dialogues about longer-term climate change and its potential impacts. This paper discusses some of the strategies used to communicate with members of the public about climate and suggests ways in which this process may facilitate communication of climate change information.

INTRODUCTION

Society has come a long way from the days when weather and climate had to be taken seriously in everyday life. Technological innovations now buffer most of the vicissitudes of climate, and widespread, instantaneous availability of information from sources such as radio, television, and the Internet have eliminated much of the guesswork associated with many weather- and climate-related decisions. Most weather information is provided at time scales ranging from a day to perhaps a week or two. However, in recent years improvements have been made in the ability to forecast climate as much as six months to a year or more in the future. The confidence level of these forecasts varies considerably, depending on region, antecedent conditions, and other factors, but in cases where confidence levels are relatively high, as in the case of winter precipitation and temperature forecasts for the U.S. Southwest, the forecasts can provide an important source of information for planning and decision making. Longer-term modeling of climate change has likewise progressed substantially over the past few decades, but continues to be viewed with considerable skepticism by many people. Communication of information about natural climate variability at regional and local scales holds considerable promise for providing an important foundation for improving dissemination and acceptance of information about longer-term climate change.

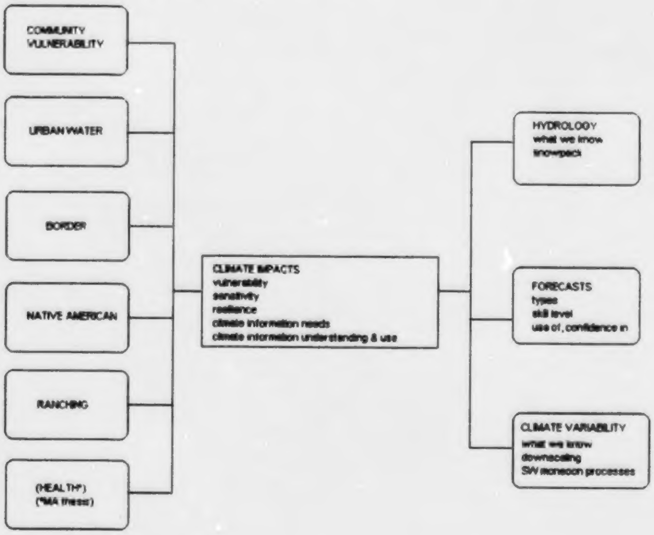
Integrated assessments, particularly those that explicitly integrate stakeholders in all phases of the research process and that approach problems from multiple perspectives (see, e.g., Rotmans and Dowlatabadi 1998), provide valuable opportunities for building the kind of knowledge bases needed to effectively assimilate and use information about both natural climate variability and about climate change. The Climate Assessment for the Southwest (CLIMAS) Project is one such program. Through use of surveys, conferences, workshops, and other such strategies, the project affords abundant opportunities for imparting climate information to the public, as well as for enhancing the flow of information from stakeholders to researchers. Indeed, improving the effectiveness of communications regarding climate and climate impacts has been identified as one of the crucial elements in improving resilience and coping capacity with regard to climatic conditions (see Stern and Easterling 1999). As discussed below, gathering and disseminating information at local and regional scales is a particularly effective means for achieving the transfer of knowledge and information about climate. This information, in turn, can provide the basic knowledge needed to develop compelling place-based narratives that can be used to diminish the gap between the public and its life support systems and to enhance the probability that we will indeed achieve a sustainable future.

Climate Assessment for the Southwest (CLIMAS)

The Climate Assessment for the Southwest (CLIMAS) project is one of several regional climate impacts assessment projects in the United States funded by the U.S. National Oceanic and Atmospheric Administration's (NOAA) Office of Global Programs (OGP). The mission of CLIMAS is to examine the impacts of natural climate variability on human and natural systems in the southwestern United States, a region that encompasses Arizona and New Mexico and the adjacent U.S.-Mexico border region. CLIMAS is currently focusing on assessment of climate vulnerability in selected communities, the urban water sector, borderlands, and the ranching sector, as well as climate impacts on Native Americans in the region (see Figure 1 below). A study of the relationship between climate and incidence of a disease endemic to portions of the U.S. Southwest and Mexico, cocciodiomycosis (valley fever), is also being carried out.

Natural science research being carried out in support of these initiatives includes developing better information about snow-pack conditions in key watersheds, a better understanding of the North American Monsoon, and downscaling and interpolation of historical and paleo information to finer geographical scales. In tandem with these initiatives, evaluation of the skill level and utility of climate and hydrologic forecasts is underway.

FIGURE 1
CLIMAS as an Integrated Assessment


COMMUNITY VULNERABILITY
URBAN WATER
BORDER
NATIVE AMERICAN
RANCHING
(HEALTH*)
(*MA thesis)
CLIMATE IMPACTS
vulnerability
sensitivity
resilience
climate information needs
climate information understanding & use
HYDROLOGY
what we know
snowpack
FORECASTS
types
skill level
use of, confidence in
CLIMATE VARIABILITY
what we know
downscaling
SW monsoon processes

CLIMAS is designed to be a stakeholder-driven assessment; therefore, the research agenda derives in large part from the needs and concerns expressed by stakeholders in the region. Initial stakeholder input was generated through a global change symposium and workshop jointly sponsored by the U.S. Department of Interior and NOAA-OGP (Merideth et al. 1998). Subsequent input continues to be benerated through survey work and other activities carried out by CLIMAS team members.

Public outreach is an indispensable component of CLIMAS, particularly with regard to disseminating information about the region's climate and its impacts. The outreach component, carried out through the CLIMAS core office, involves ongoing two-way communications with targeted stakeholders, as well as with the general public, government agencies, and researchers both within and outside the region. The following discussion outlines some of the strategies CLIMAS is using to establish and maintain communications with its constituents in the U.S. Southwest.

STAKEHOLDER SURVEYS

Conducting surveys is indispensable in identifying and establishing contact with stakeholders in the region, as well as in documenting the nature and extent of climate impacts and ascertaining climate information needs. The process allows stakeholders to communicate knowledge and concerns to researchers, and provides an opportunity for the researchers to share their knowledge with the stakeholders. These initial contacts also prepare the way for subsequent interactions. Examples of the kinds of surveys being carried out by CLIMAS are briefly discussed below.

Pilot Stakeholder Survey

In 1998, CLIMAS team members conducted a structured survey of a cross-section of 72 stakeholders in southeastern Arizona (Benequista et al. 1999). The survey results indicated that respondents' need for climate information ranged from popular-media weather forecasts to complex, sophisticated information obtained from climate and hydrologic forecasters. However, the findings also indicated that only half of the interviewees used some type of climate information. In terms of specific information needs, ranchers were most concerned about precipitation patterns in their local area, while farmers cited interest in maximum and minimum temperature information, climate conditions in agricultural areas outside the Southwest, and forecasts for the growing season. Public officials were interested in information that linked climate with environmental and economic impacts, but tended not to see an immediate, direct connection between climate and their job responsibilities. Emergency response managers expressed interest in real-time streamflow, estimates of rainfall intensity, forecasts for drought duration, and up-to-the minute information on storm conditions and fire activity. The managers in the larger metropolitan areas indicated that they use of longer-lead climate forecasts, while their counterparts in smaller communities said they relied on short-term weather information. The two large utilities in the survey were somewhat unique in that their use of climate information was more multifaceted; further, this was the only occasion where global warming was raised as a topic of interest.

El Niño Survey

A special survey was carried out during 1998 to ascertain how selected emergency managers and water managers in the region were using climate forecasts issued for the 1997-1997 El Niño event (Pagano et al. 1999). The El Niño-Southern Oscillation (ENSO) process exerts a strong influence over climate in the Southwest, particularly during the winter half-year (see Sheppard et al. 1999), with El Niños generally producing higher than normal precipitation and somewhat cooler temperatures, and La Niñas producing lower than normal precipitation and somewhat warmer temperatures. Given that some of the worst flooding in Arizona has occurred during El Niño events and that the forecast for a relatively strong El Niño was forecasted months in advance of the 1997-98 winter season, the event presented an important opportunity to gather information about the use of the forecasts. The context was unique in that it was the first time that substantial amounts of information about such an event was widely available through the Internet. Indeed, the Web served as a primary source of information for reporters as well as for resource and emergency managers.

Assessed qualitatively, the 1997-98 climate and water supply outlook forecasts were fairly accurate, in that precipitation and surface water flows were above normal. However, all but two of the 17 emergency managers and water managers interviewed proceeded with 'business as usual,' regardless of the forecasts. The two respondents who did take the forecasts into account were managers of large surface water and groundwater resources; both decided to decrease groundwater pumping in anticipated of higher surface water flows. One of these managers estimated a cost savings of about $1 million as a result.

The survey revealed that whether or not managers used the information provided hinged on two factors: confidence in the forecasts and structural/institutional constraints to incorporating the information into plans and activities. Perceived accuracy of the forecasts was especially important. Respondents noted that they assessed the accuracy of the forecast information in terms of how consistent the predictions were, how well the forecasts accorded with the findings of their own in-house research, and their own memory of the consequences of previous, analogous events. In terms of structural and institutional constraints, important factors included the lead time required to construct or repair infrastructure, hire additional staff, and obtain funds to accomplish these and other tasks were noted as barriers to action. This was found to be particularly true for less well-funded operations. Other institutional constraints noted in the study included lack of flexibility in changing the ways of doing business, potential consequences of making a non-routine decision, and lack of opportunity to insert the new information into the decision making process. Also emphasized was the fact that potential El Niño impacts constituted only one of many—often more important—influences on the managers' agendas.

Results of the survey suggest that successful diffusion of climate forecasts requires a strong emphasis on convincing stakeholders to evaluate the benefits of using forecasts in terms of enhancing the security and stability of their operations, relative to having no such information at all. Further, the study noted that climate experts need to focus on specific sectoral areas and to work specifically with stakeholders in those sectors, thus addressing stakeholders' predilection to work only with individuals/sources they know and trust.

Surveys Done in Conjunction with Vulnerability Assessments

Climate vulnerability analysis involves assessing how, and the extent to which, an identified group or sector may harmed by climatic conditions (see, e.g., Liverman 1999). CLIMAS has undertaken vulnerability analyses of the town of Benson, Arizona and surrounding communities (Austin et al. 1999), the ranching sector in Arizona (for a preliminary assessment see Conley et al. 1999), and urban water providers in Arizona (in progress; see Carter et al. 2000). Results from these surveys indicate that patterns of vulnerability are complex, but that stakeholders reliant on climate-dependent natural resources (most notably farmers and ranchers) are most vulnerable to climate variability. For ranchers, adverse climate conditions (drought and consequent lack of forage, temperature extremes) during calving season can be of particular concern. Many water managers have not expressed much concern about climate stresses, believing that they have incorporated sufficient buffers to accommodate the worst-case conditions that have occurred in the recorded past. Pockets of vulnerability do exist in this sector, though. Preliminary analysis of a survey of water providers revealed a number of climate-related concerns, including high evapotranspiration rates (leading to elevated outdoor water consumption), deep and extended drought conditions, and power outages caused by heavy winds, electrical storms, and extremely high temperatures.

Many individuals contacted expressed interest in receiving climate information. However, some have often developed their own strategies for tracking climate conditions, and may have much greater confidence in such information than in the information presented by climate professionals. Further, it is important to note that stakeholders often experience greater stresses from regional to global scale markets, urban encroachment, federal, state, and local laws and regulations, and financial markets. In such cases, climate may be a contributing factor at best. Findings indicate that stakeholders generally want information that is specific to their area of interest. This can range from the scale of the watershed of the upper Colorado River to that of an individual ranch.

PUBLIC MEETINGS

Basic awareness about climate impacts on water resources in Arizona is currently being stimulated through participation in a water management task force process organized by the Arizona Department of Water Resources (ADWR). Participation has contributed to building a link between CLIMAS and water providers and has enhanced understanding of key water issues. The CLIMAS team member participating in the task force has underscored the need to incorporate climate variability more fully into the laws, policies, and procedures governing water management in the state by submitting a special issue paper. This issue paper, which discusses the implications of climate variability and longer-term climate change for water resource management in the state, is currently under review by the task force. The issue paper is intended to address the basic problem that much of the institutional structure for water management in the state remains organized around an idea of "normal" climate conditions, or at best, a range of climatic extremes derived from historical records. This is particularly important because the Southwest is characterized by a high degree of climate variability at seasonal, interannual, and interdecadal time scales.

Some of the issues developed through the task force process will be forwarded to a blue-ribbon Governor's Commission, which is charged with recommending changes in the legislation governing water resources in Arizona. The task force process has provided an opportunity to raise awareness about issues of longer-term climate change, as well as natural climate variability among participating water providers. Further, the director of one of the State's water regulatory offices has been an active participant in the U.S. National Climate Assessment process currently underway. This has resulted in an unprecedented level of expertise in the subject being brought to the process of disseminating climate change information within the Arizona water sector.

COMMUNITY-ORIENTED CONFERENCES

CLIMAS was a co-organizer (along with the Semi-Arid Land Surface Atmosphere [SALSA] project and the U.S. Environmental Protection Agency [EPA]) and participant in a binational, community-oriented conference, entitled "Divided Waters-Common Grounds." The conference, which took place in Cananea, Mexico and Bisbee, Arizona, was designed to disseminate science information and identify issues associated with management of the San Pedro River. The river, a continuing subject of intensive research, rises in Mexico outside the mining town of Cananea and flows northward into Arizona, eventually converging with the Gila River north of the town of Benson. The upper portion of the river is widely known as one of the last intact, natural riparian ecosystems in the Southwest and as a major flyway and seasonal habitat for migratory birds. Climate variability is clearly an important factor in management of the river and its watershed.

Participation in the conference provided valuable opportunities to experiment with ways to present scientific information to the public, and to identify what types of knowledge transfer methods work best in specific circumstances. At the conference, much of the knowledge transfer from the scientists to the public was accomplished through poster presentations. For example, one CLIMAS poster illustrating the possible impacts of severe one-, five-, and ten-year droughts on the water budget of the nearby city of Sierra Vista; others reported on CLIMAS forecast evaluation activities and on the community vulnerability study.

Information transfer from the community members to the scientists was accomplished through a series of discussion sessions framed around pre-determined, but broad,specific questions. Each session was moderated by a trained facilitator, and was conducted in a manner that encouraged identification of local issues and recommended solutions to those issues. While climate was not a notable topic in these discussions, the expressed concerns (for example, groundwater depletion on both sides of the international border) have strong climate connections. By participating in these sessions, CLIMAS team members were able to enhance their comprehension of local culture and concerns, and to identify where climate factors into the issues raised. One outcome of participation in the conference was identification of a potential project to incorporate climate variability and climate change indicators into a set of indicators being developed to monitor the health of the San Pedro ecosystem.

STAKEHOLDER WORKSHOPS

CLIMAS has sponsored two climate workshops in Tucson and participated in a Climate Diagnostics Center (CDC) and Western Regional Climate Center (WRCC)-sponsored workshop held in Albuquerque, New Mexico. All of three of these workshops were organized to communicate information about the 1999-2000 La Niña forecast to stakeholders, and to educate participants about climate processes and forecasts more generally. The climate forecast workshop held in Albuquerque in October, 1999 included climate specialists and an array of individuals representing different stakeholder interests. A similar workshop CLIMAS-sponsored workshop was held at the University of Arizona in November 1999. Both workshops allocated a considerable portion of the one-day session for open discussion, allowing stakeholders abundant opportunity to describe what they do, what kinds of climate information they use, what they use the information for, and what additional information they would like to receive.

One of the chief outcomes of the Tucson workshop was organization of a special workshop focused specifically on exploring how climate information might be incorporated into forest and grassland fire management decision making. This workshop, co-sponsored by the University of Arizona's Institute for the Study of Planet Earth (ISPE), CLIMAS, and Laboratory of Tree-Ring Research, was held in Tucson in February 2000 and lasted a day and a half. It brought together an expert group of climate specialists, fire researchers, and fire managers from the US Southwest, Southeast, and Northwest. These geographical regions were targeted because they are the major focal points of fire hazard concern, share the same fire fighting resource base, and share concerns about fire regimes influenced by climate variability at interannual and/or longer time scales. The timing of the workshop was critical, for the organizers knew that the information had to be disseminated before plans and supplemental budget requests for the coming fire season were completed. Moreover, considerable research indicates that there is a strong, though lagged, connection between multi-year climate patterns and wildfire regimes in the Southwest. Tree-ring research linking wildfire with ENSO patterns (Swetnam and Betancourt 1998) has revealed that, in the Southwest, some of the largest fires over the past 400 years have occurred when unusually wet climate conditions were followed by two drier than normal years. By the time the workshop was held in February 2000, it was clear that this would be the pattern for the upcoming fire season. Combined with high fuel load buildups and increased development at the edges of major forest areas, the outlook was for a very high fire hazard in both the Southwest and Southeast regions of the United States. No definitive prognosis was available at the time of the workshop for the Pacific Northwest, due to the fact that it was still too early in the season. However, potential fire hazard in that region was a concern to participants, for if more wildfires emerged in the Pacific Northwest than expected, an even greater strain might be placed on the available fire fighter crews and equipment.

Presentations at the workshop revealed that, while some researchers, such as those at the Riverside and Missoula Fire Laboratories, are beginning to look at longer-term patterns, most of the modeling and other research being done still focuses on short-term weather conditions. Nevertheless, the recent rise in the skill of ENSO-based winter climate forecasts, and a concomitant rise in confidence in those forecasts, have opened the way for much greater interaction between climatologists, fire researchers, and fire managers in forecasting fire seasons farther in advance. Furthermore, national fire policies, which now require resource managers to develop fire management plans over a 100-year period, provide a foundation for pursuing development of a more sophisticated array of information about climate variability and change. The climate and fire management workshop was successful in large part because the focus was on one particular sector that stood to be heavily affected by the combination of the Winter 1999-2000 La Nina forecast and antecedent conditions, allowing for a mix of participants sharing a common interest. The workshop was also successful in that it provided an unprecedented opportunity for fire managers and researchers to interact with climate specialists, and because it opened the way for an ongoing dialogue between climate specialists and fire managers and researchers. Indeed, participants were in agreement on the importance of continuing that dialogue and developing joint research projects. CLIMAS plans to hold a follow-up workshop in the Fall to review the outcomes and to identify next steps.

BUILDING ON CLIMATE VARIABILITY TO COMMUNICATE CLIMATE CHANGE INFORMATION

The kinds of methods discussed above have application to communication of climate change information, as well as information about natural climate variability. Establishing systems to track forecast skill levels and incorporating more detailed confidence-level statements into the forecast materials are important in generating stakeholder trust (see Pulwarty and Redmond 1997, Hartmann 1999). At the same time, a basic educational level must be developed among stakeholders and the general public with regard to how to interpret and use climate information.

Many avenues exist for communicating such information to stakeholders, politicians, government bureaucrats, and the general public. Determining which avenue is best depends on the specific information to be conveyed, and the audience to whom the information is directed. Consideration of the specific context in which the information is (or might be) useful; the mix of capabilities and barriers that each decision-maker faces in deciding whether or not to use the information provided is also important (see Nicholls 1999). Making sure the information is intelligible to intended users is of course essential, as is furnishing the information at the time the user needs it. At the same time, stakeholders need to understand the extent to which climate specialists face limitations in explaining and predicting climate and its impacts, due to current limits in knowledge about atmospheric and other processes. In addition, modifications in procedures, such as the upcoming change in the thirty-year period used by NOAA to define "average" climatic conditions can pose considerable challenges to developing a solid knowledge base from which to make decisions. These and other considerations highlight the importance of viewing communications as a long-term commitment requiring patience, persistence, and intelligent experimentation on the part of everyone involved. It also involves a dedication to ensuring that unrealistic expectations about what sorts of information can be delivered and when, as well as a determination to follow up on those needs which can reasonably be met.

FUTURE DIRECTIONS

Is it true, as Shakespeare said, "the past is prologue?" Science based on conditions in the far past or in the future can be very difficult communicate effectively to the general public. Indeed, we certainly do not know whether, or to what extent, the future may be like either the present or the past. However this should not forestall efforts to transfer knowledge about climate and its local, regional, and global impacts. Creating regionally or locally anchored narratives that link scientific knowledge to a story people can identify with is one promising strategy (see National Research Council 1999). For example, narratives about past fire patterns and links with climate, presented within the context of people's everyday lives, expectations, and value systems could set the stage for more in-depth science dialogues. If developed through dialogues with carefully selected stakeholders, such narratives could establish a foundation for the development of a richer set of plausible scenarios of future conditions, setting research agendas, and formulation of better-informed long-range plans. Not all scientists are interested in taking this route, nor do they necessarily have the expertise to do so. However, those who can tell a good story, and who have an abiding interest in how people view the world should be rewarded for using their talents to build bridges between science (including paleo science) and society. Such rewards are still far too scarce, especially within the traditional academic world.

Working on interdisciplinary teams of physical, natural, and social scientists engaged in regionally or sectorally focused integrated assessments is another excellent way to build the bridges necessary to effectively communicate information about natural climate variability and about climate change. As indicated by the CLIMAS experience, many benefits can be gained from stakeholder-oriented integrated assessment research, not the least of which is developing informed constituencies who are qualified to articulate issues and advocate the kinds of changes needed to meet the challenges identified through the integrated research process. In the long run, such efforts to bridge the gap between science and society will advance the goals of achieving environmentally sustainable societies and assuring a desirable future for posterity. ❑

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Bringing Climate into the Daily Weather Broadcast

Lucy Warner

With funding from the U.S. Environmental Protection Agency, the authors have created a series of video B-roll packages for weather broadcasters, called ClimateStock, that relates daily weather events to climate change. Each bout of seasonal extreme weather brings new inquiries from the media. Was the mildness of early winter 1999-2000 a sign of global warming? Are greenhouse gases bringing more frequent or stronger hurricanes? The weather broadcasting community plays a pivotal role in disseminating accurate and easily understandable information to the public, yet that group often lacks background materials and sometimes even the basic understanding to make global change issues clear and understandable. The goal of ClimateStock has been to broaden the scope of weather coverage to discuss climate issues. The series also targets news and documentary producers. It includes sample scripts, sound bites, animations, and stock footage. One of our biggest challenges has been timing: not surprisingly, the most successful products have been those with strong news pegs. Weather broadcasters are not uniformly persuaded by the threat of global warming but have been receptive to the series. Because the ties between weather and climate continue to be quite speculative, communicating the nuances of the message has been difficult. However, some broadcasters have used our suggested scripts nearly verbatim, increasing our confidence that ClimateStock and efforts like it have a worthwhile role to play in communicating about climate change.

INTRODUCTION

The daily weather report may be the only readily accessible scientific information that reaches the general public every day, and its popularity is growing. The Weather Channel is now viewed by 15 million people at least once a day.[1] On the network news, weather stories have been among the top-ten topics for the past three years, outranking health, sports, and other popular items.[2]

Coverage of climate change can profit from this boom. Reporters are always keen to find out if the latest weather event is more than "just weather," and they look to climatologists to give them reputable answers. The belief that human misdeeds are inviting natural retribution is as old as the ten Egyptian plagues of the Old Testament. The idea that there is more to weather extremes than just routine natural fluctuations fits so easily into this cultural predisposition that if anything we must be careful not to overplay the global warming connection. (For example, Dan Rather took the possible connection between warmer climate and more severe storms and reported that tornadoes such as one that struck in Nebraska May 24 would be more frequent with as the climate warms— a claim for which there is no basis whatsoever.)

At the University Corporation for Atmospheric Research, we have designed a program to bring together the growing interest in weather and concern about changing climate. Through a grant from the Environmental Protection Agency, we have devised a series of packages that ties events like winter storms and hurricanes to research on how climate change plays out in day-to-day weather. The packages include suggested scripts of roughly two minutes and three categories of video footage—animations, sound bites, and background shots.

We have issued seven of these packages, which we call ClimateStock, and have monitored their use. The first came out in the fall of 1997, at the height of the El Niño media blitz, and was updated the following March. That year, weather and natural disasters were the fourth most heavily covered topic on network news [2], and our product reached over 20 million viewers. Our second most popular offering has been on hurricanes, reaching 9 million viewers. Other topics with less-immediate news pegs (global temperatures and climate change, pollution and climate) have reached smaller audiences.

What lessons have we learned from this effort? First, some cautions:

- **Drama sells.** Weather stories' increasing popularity is tied to a growing sensationalism in broadcast journalism. In 1998, the year El Niño brought weather to the headlines, the Clinton-Lewinsky scandal was the top t.v. news topic and crime news came third after the economy and business. Local news is increasingly focused on shootings, fires, and car crashes. Floods, hurricanes, and blizzards—which are immediate, visually dramatic, and cause destruction and sometimes death—are naturals in this news environment, and if there is a climate implication, reporters will listen. It's harder to get them to pay attention to drought and pollution, which are longer-term, visually passive, and more subtle in their damaging effects.

- **Nuance is hard to communicate, especially on television.** In ClimateStock, we have been very careful not to exaggerate the climate connection to weather. Precipitation is likely to increase in some areas with climate change but not everywhere. The effect of warmer temperatures on future El Niños is not certain, nor is the connection between hurricanes and warmer climate. There is no connection between tornados and global warming . Television news is abbreviated and visual. These are not easy messages for broadcasters to convey. However, it is important to address these questions, particularly given people's predisposition to attribute storms to factors beyond routine weather. Scientists can be coached to deliver short, incisive sound bites that are not oversimplified: "There is some evidence that. . ." "We know X, but we don't yet know Y."

- **Weather is local; climate analyses are mostly global.** Weather happens at the local and regional levels. We are only just beginning to figure out how climate change will play out on those scales. The national networks want to know how climate change will affect the Southwest or the Northeast, not how global mean temperatures will shift. The local weatherbroadcaster would love to report that by 2050 Tampa will have fewer freezes or Chicago 50% more 100-degree days. We simply don't have that information. However, local weather broadcasters can begin to introduce climate issues by reporting on current local trends such as monthly averages and departures from normal.

- **Meteorologists are not trained to understand climate.** A typical meteorology degree generally includes only a course in climatology at most, and only some t.v. weathercasters have the equivalent of a meteorology degree. In addition, many t.v. people got their training before global change became a major national concern.They have roughly the same preconceptions and misconceptions as the general public, [3] and many of them are climate warming skeptics. Beyond our current program, we need efforts at educating the broadcasters themselves.

However, despite the caveats discussed above, broadcasters are eager for timely and authoritative information.

- **If you provide it they will use it.** Broadcasters have daily deadlines and don't have the time they would like to research stories; the burgeoning number of cable stations has created an enormous demand for footage. Reporters and editors are extremely grateful for reputable help (as are documentary producers). Animations are costly to produce and the technically accurate products we can issue from a research institution are unlikely to reach a mass audience without a program like ClimateStock. Our background footage has shown up everywhere from a Japanese documentary on future agriculture to the recent Frontline/NOVA production "What's Up with the Weather." Despite the absence of "point-counterpoint"debate, our soundbites are used.

CONCLUSION

In summary, weather news is of universal interest and growing in popularity. We must resist the temptation to oversell the climate connection but use the opportunity to let people know what we honestly do and don't know about how future climate will affect their day-to-day lives.

More information on ClimateStock can be found at http://www.ucar.edu/climatestock. ☐

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Session G2

EFFECTIVE EXCHANGE OF CLIMATE CHANGE INFORMATION: THE ROLE OF LIBRARIES AND THE INTERNET

Global Climate Change Information: The Role of Libraries in Removing Barriers to Information
Frederick W. Stoss
University of New York at Buffalo

Regional Community Web Site
Jeanne Bisanz and Peter Sousounis
University of Michigan

Climatechangesolutions.com: A Study of How the Internet Creates Action
Janet Sumner
Pembina Institute

Global Climate Change Information: The Role of Libraries in Removing Barriers to Information

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Libraries serve as highly trusted and effective institutions to organize, manage, and store collections of information. Librarians and information professionals are primary gateways to these collections and the services and resources supporting them. International research agendas and policy initiatives related to global change provide libraries and librarians new opportunities for identifying, obtaining, managing, storing, and disseminating current data and information in new formats and through new channels of communication. Librarians have played important roles in the U.S. Global Change Research Program's Global Change Data and Information System. Their expertise has been used to: develop metadata and data standards and directories, build Web pages (including their search capabilities, menu-driven interfaces, and content), improve access to data and information resources via the Internet and World Wide Web. Librarians have also lead data and information management activities to improve identification of, access to, and sharing of electronic AND print forms of data and information. However, new opportunities also come with new barriers to change. These barriers represent limitations to convey our scientific understanding of complex phenomenon (such as climate change), inadequacies in (and access to) the technologies needed to obtain and organize scientific and policy data and information, and our ability to effectively and efficiently share data and information in an equitable manner. International global change research programs provide libraries and librarians new roles and responsibilities to facilitate the sharing of data and information resources across disciplines, lines of work, and personal agendas. This presentation will examine the roles of librarians in sharing data and information resources and how public, academic, government agency, and special libraries can be used as active partners with research and policy communities in sharing global climate change data and information. Included in this discussion will be an overview of incorporating climate change data and information resources into and Environmental Information class in the Master of Library Science program at the University at Buffalo.

INTRODUCTION

Ready and reliable access to data and information is increasing in importance as an integral part of the environmental decision-making process. Research results, regulatory requirements, policy initiatives, and increased public awareness and concern about the issues related to global climate change have a dramatic impact on constituent groups. Project managers, business leaders, research scientists, policy analysts, program administrators, elected officials, educators and their students, and the concerned citizen need efficient, effective, and equitable access to data and information to adequately address their issues related to climate change. Their need for new data and information products, new publications and documents, new reference and referral services, and new data and information delivery services is a challenge for today's librarians and information professionals. Librarian developing and providing such services and programs for this multidisciplinary audience are building bridges to facilitate information, communication, and education gaps between constituent groups and foster a greater cross-disciplinary exchange of information, resources (materials and expertise), and ideas. (1)

Today's librarians find themselves in roles far removed from the traditional roles as catalogers, indexers, and collection caretakers. Their skills are needed to collaborate with researchers, policy makers, educators, administrators, and executive as they

- Evaluate software for data and information management

- Develop profiles of information products, research projects, business plans
- Oversee the production of reports, reference books, Web sites, and other information tools
- Develop and maintain databases
- Write articles and reports
- Provide training in the use of manual- and online data and information systems
- Develop marketing strategies for the effective delivery of products and services

There are, however, barriers that prevent the efficient, economic, and equitable access to data and information resources. The type of users seeking access to data and information defines many of these barriers.

INSTITUTIONAL AND CULTURAL BARRIERS TO CLIMATE CHANGE INFORMATION

The first barrier to communicating climate change information is based on the institutional setting in which the individual or organization needing information is found. There are two major goops of information users that are broadly categorized by the institution they represent, whether it be a university research laboratory, government research administration office, elected official, high school classroom, nonprofit special or public interest groups, or as a concerned citizen.

Primary users of climate change data and information are usually professionals actively working in a field of study related to climate change. Such professionals most often have ready access to data and information resources, have the technical abilities to understand and synthesize the data and information without interpretive assistance. Researchers (in all appropriate disciplines of study) and scientists (representing the applied, life, physical, and social sciences) are representatives of this group of information user.

This primary user group has a rather high level of expertise achieved through academic and employment experiences. They usually are able to meet their data and information needs within the information infrastructure with which they are familiar, and usually designed along disciplinary lines of study. This group of users also represents the major source of data and information and wears the second hat as climate change data and information provider.

Primary users typically work in institutions that have an information management system, computer hardware and software, libraries and information professionals to supplement their own knowledge base within their disciplinary areas of work. Not only do they have adequate resources and means to access them, they have the professional skills to analyze and evaluate the data and information resources available to them. Their biggest information need is to have a ready and steady stream of information to satiate their (research-oriented) needs, which in turn are used to support their research agendas and programs.

A second type of moderate information user emerges as a distinct group of individuals, organizations, or institutions who lack the in-depth and comprehensive skills to fully analyze and evaluate the scientific and technical data and information in a research or policy context (i.e., they are not scientific or technical "experts"). While this group of users has an acute need for data and information on climate change, they do not have the requisite analytical skills to directly evaluate the data. They are, therefore, not as concerned with data (numeric, qualitative and quantitative data) as are primary users. This secondary user groups is, however, extremely dependent on the documents and literature that has synthesized climate change data in analytical and evaluative forms.

This secondary group of users may not have ready access to data, data sets, database, and information files, but are none-the-less dependent for professional purposes the contents, interpretations, evaluations, and implications of that data and information in more global contexts. Not only does this group have a more restricted access to the data and information resources, they also may have less knowledge about the availability and evaluative tools for processing data and information. This group is often highly dependent on the former group of primary users/producers of data and information, who serve as surrogates for data and information interpretation and evaluation. Elected official and government agency administrators and their staffs, public and special interest group staffs, K-12 teachers, reporters and media specialists, students (studying in specific climate, energy, environmental disciplines), business and industry managers, and scientists and researchers working OUTSIDE of their area(s) of expertise can be included in this group.

There are other more peripheral user groups and individuals such as, students working outside their areas of study, members of public interest and nonprofit groups, and concerned citizens and advocacy groups that are not only dependent on others (and their literatures) for analyzing, evaluating, interpreting, and using specific climate change data and information, they also uniformly lack ready access to and knowledge of the databases and information infrastructures available to them. This last group of users is more dependent on libraries and librarians to meet their information (not data, for this last group has very little use for or understanding of data related to climate change) needs.

Because of the lack of scientific, technical, or disciplinary understanding of the topic this last group of users is one most susceptible to unreliable, misleading, and inappropriate use of information. This group represents one of the greatest challenges to the global change research and policy community for more effective and complete outreach and learning. It is a group for which resources are sorely needed and promoted for their use.

Libraries and librarians are called upon to match the data and information resources to the needs of the user with which they are dealing. It would be inappropriate to provide a 7th grade junior high school student with a research paper from the journal *Climatic Change* or *Atmospheric Environment* and expected them to have a knowledge of the paper's contents and meaning. There are, however, many resource appropriate for junior high school students for class and science fair projects. It would also be as in appropriate to provide an atmospheric chemist with an information fact sheet on the mechanics of the greenhouse effect, unless that researcher is looking for a handout to provide attendees at a local meeting of Trout Unlimited.

Librarians deal with the issues of economies and equity on a daily basis. One of the basic functions of library reference is to match the level and content of their replies to the needs of the user. Many library students receive instruction in the reference process as part of their training in becoming professional librarians. While the satement describing this function might sound simple, the process by which it is implemented in not. The basic function for the reference librarian is to take the user's statement related to the information they **want** and translate their actions into providing the information they **need**. Library reference services are provided to address the users concerns for accuracy, economy of access, and equity of access.

Recent developments providing data and information resources (from numeric data sets on carbon dioxide emissions to PDF formats of simple information brochures and Web sites announcing and describing conferences, such as this one) have greatly enhanced the users access to information. It is hoped that both the producers of information and the users of that information realize the value of the librarian as an information tool to assist in the process for identifying, obtaining, using, and sharing data and information resources.

SCIENTIFIC BARRIERS TO CLIMATE CHANGE INFORMATION

International scientific research programs spanning decades in their duration have contributed greatly to our understanding of the biogeochemical dynamics of the Earth's biotic and abiotic resources. This research effort presents a tremendous challenge in the understanding of the complex nature of ecological systems and their interactions. These interactions involve mechanics and dynamics of chemcial, biological, physical, and social sciences from the depths of the ocean to the upper reaches of the Earth's atmosphere.

The worldwide global change research programs struggle with these scientific and technical complexities which are exacerbated by issues of scale from regional to national to global dimensions; and issues of scale that range from the immediate to several centuries in duration between cause and effect. As our resolution for measuring and predicting change increase so does the need for sophistication of information and information delivery systems increase.

The issues of spatial and temporal change are among the most difficult to convey even among scientific disciplines. These issues are often cited as causing tremendous degrees of confusion among non-scienitific audiences, including those who are called upon to make critical decisions about research priorities, strategies for remediating problems, revising the allocation and uses of natural resources. Along each step in the research and policy process is the need for information that, according to Root (1992):

- is reliable
- covers adequately the subject are for which information is needed
- is accessible to those who need it
- is understandable to those who wish to use it

LIBRARIES OVERCOMING SCIENTIFIC BARRIERS

It is a great challenge for our libraries and librarians to assure access to and discern the quality of climate change data and information that stands up to the measures of reliability, adequacy, accessibility, and comprehension. Librarians serve as stewards of the information and knowledge base of their library's holdings through strategies they employ in developing collections of books, technical reports, research journals, monographs, reference works, and other forms of print and non-print resources (including electronic and digital resources).

Library collections are developed through cooperation and idea sharing among librarians (who identify and obtain information) and researchers, policy makers, educators, managers, and others who state specific information needs. Librarians rise to the challenge with a variety of tools: catalogs, indexes and abstracts, reviews, peer-exchanges, recommendations, and their own in-depth, academic understanding of the subject matter, to facilitate the building of library collections. The development of subject- and issue-specific library collections is a basic function of librarians, and one that has a tremendous potential for interactions among librarians and other segments of the community of information users.

Of particular interest is the professional working relationships librarians develop among peers and other practioners in research, education, and policy settings. It is through these relationships that librarians are guided in the selection of data and information resources appropriate for the users of their library. The need for librarians to network among their peers, producers and publishers of information, and their user communities will determine the success with which they are able to meet specific data and information needs that often cross lines of disciplinary study in the applied, life, physical, and social sciences.

A major extension of library collection development comes into play when a library does not have immediate access to a desired piece of information. Librarians my employ a number of time-honored referral services, based primarily on their personal knowledge of where appropriate data and information resources are found. In this context the professional networking among librarians is essential to facilitate a cross-disciplinary exchange of resources

The most visible library resource-sharing program is the international arrangement honoring interlibrary loans (ILLs). As defined by the National Interlibrary Loan Code for the United States, 1993, "Interlibrary loan is the process by which a library requests materials from, or supplies materials to, another library. The purpose of interlibrary loan as defined by this code is to obtain, upon request of a library user, materials not available in the user's local library." For specifications on ALA's role see: http://www.ala.org/library/fact8.html

Most libraries extend the limits of their collections by making a full range of interlibrary loan (ILL) services available to their users. Limited ILL services may be extended to those not officially belonging to a library's user community. The services provided through various consortia and lending networks are governed by the conditions set by the interlibrary loan code of the American Library Association and by the regulations of individual lending libraries. Requests for photocopies may fall under the restrictions imposed by the federal copyright guidelines enacted in 1976 (Title 17 U.S. Code). These services may be provided free of charge to the user (typically in academic and school libraries), are provided on a cost recovery basis, or may be used to provide a revenue-generating function for the library.

Informal referral services are another tool librarians employ to provide a user with resources not held in their library. Such referral services are based on the librarian's knowledge of where specific data and information resources are or most likely will be found. Directories of information resources, research centers, special library collections and special librarians, data archives and information analysis center are among the most frequently used tools for providing referral services.

It is, therefore, necessary for the librarian to have a working knowledge of the special collections of other libraries, national and World Data Centers, information clearinghouses, data archives, and information analysis centers. This networking among librarians is developed through participation in the professional associations as societies of librarians and data and information managers, such as

American Association for Information Science
http://www.asis.org

American Library Association (Task Force on the Environment/Social Responsibilities Round Table, Science and Technology Section of the Association of College and Research Libraries, Public Library Association, American Association of School Libraries, Federal Libraries Round Table, Government Documents Round Table)
http://www.ala.org

Association of Research Libraries
http://www.arl.org/

(U.S.) Environmental Protection Agency National Library Network
http://www.epa.gov/natlibra/

Libraries for the Future
http://www.lff.org

Natural Resources Information Clearinghouse
http://www.usu.edu/~cnr/quinney/nrichome.htm
Office of Fish and Wildlife Information Managers
http://fwie.fw.vt.edu/ofwim

Special Libraries Association (Environment and Resource Management Division/State Agency Libraries Forum, Science and Technology Division)
http://www.sla.org

Other State and Regional Library Associations — http://www.ala.org/cro/comb.html

(These library and information associations can serve as effective communication channels for topics related to climate change, including continuing education offerings, presentation sessions, local and regional workshops, publications, eMail lists, etc.)

Another aspect of library collection development activities is the creation of subject-specific Web sites of Internet and World Wide Web resources. These library Climate Web Pages tend to reflect the specific research and education missions of the institutions in which the library is located. Climate Web sites vary considerably and this diversity is found in Appendix 1, a partial list of selected library climate Web pages.

Librarians describe these collection development activities and related sreervices, programs, projects, etc. through library and information science publications. Appendix 2 is a representative inventory highlights the library literature describing climate-related collections, tools for collection development, networking, and reference services.

TECHNOLOGICAL BARRIERS AND LIBRARY SOLUTIONS

In recent years the computer, in all of its variations from pocket/palm units to large, multi-tasking, networked, supercomputers, has been the very heart of the current information revolution. The topic of climate change has been described as one of the most scientifically and technically complex research investigation undertaken in history. It is certainly the most data and information intensive studies ever undertaken.

The combination of highly complex data and information resources, the need for sophisticated computer hardware and software to collect, manage (organize), evaluate, display, store, identify, retrieve, disseminate, and archive these data and information resources provides one of several technological barriers to information. The first barrier is access to the technologies delivering data and information resources from those that generate the data and information to those that need it.

Libraries at all levels - school, academic, government, public, and other special libraries - overcome this barrier by providing computer hardware and software, and training for their effective use. From elementary schools to university research libraries the acquisition of computer technologies grows at astronomical proportions. However, there is, at the same time, a schism developing creating a new dimension to the barrier of access to information technologies - those that have the technologies and those that do not. There are several factors that facilitate the means for overcoming this barrier. The efforts for providing grants for the purchase of computer hardware and software include those of the Gates Foundation for public libraries, and the efforts undertaken through individual state, county, municipal governments and school districts to seek funding for the public and school libraries they support.

There have been several initiatives to bring specific software capabilities and technical expertise into libraries. GIS Literacy in Libraries http://www.arl.org/spec/238fly.html was a joint effort by the Association of Research Libraries and the Environmental Science Research Institute (ESRI) sponsored program to introduce GIS technologies in libraries with grants for hardware, software, and training of librarians.

Librarians, especially those working in or with federal agencies funding and conducting climate change research, have made significant strides in providing institutional support for library-access to climate change data and information resources, services, and products. Realizing that the primary role of libraries is to organize, manage, and store collections of data and information resources, librarians representing various constituents of the U.S. Global Change Data and Information Systems created the Library Information Subgroup of the Global Change Data Management Working Group. Highlights of this Library Information Subgroup include the following action items (Rand, 1995):

GCDIS Thesaurus Project (1993) This action involved the development of alternatives to controlled vocabulary keywords. Existing keyword vocabularies, dictionaries, and glossaries were used to develop and enhance a natural language access to the growing Global Change Master Directory (a NASA/GCDIS-supported access portal to data and information resources).

Assisted Search for Knowledge (ASK, 1994-1995) The fundamental concept behind ASK was the development of a prototype system linking databases "diverse in format and content over the Internet while enabling users with different skills, needs, and access methods to obtain relevant information from these databases by using natural language inquiry and a common user interface" (Rand, 1995).

Global Change Master Directory (1989-present) The GCMD is one of NASA's contributions to the GCDIS effort. It offers a comprehensive source of information about the worldwide holdings of Earth science data and information resources for science, research, policy, and education communities.

LASR - Library Access, Search, and Retrieval Pilot Project (1994-1996) Developed at the University of Virginia LASR provided a network of public libraries, public schools, a community museum, environmental groups, community colleges, four-year liberal arts colleges, and research universities. LASR was created as a test structure to investigate the access to data and information resources across disciplines and information needs, and demonstrate a mechanism for collaboration and resource sharing in a networked environment.

Other, more technical aspects of the Library Information Subgroup included discussion related to

- Management of metadata
- Development and implementation of data and information standards for GCDIS project
- Conversion of data sets, data files, and other information resources from DIF (Directory Interchange Formats) to USMARC format
- Working with USGCRP's Global Change Education and Communications Working Group development of "Project Earthlink" (K-14 education and information awareness)
- Participating in the development of the National Information Infrastructure's Government Information Locator Service

The Library Information Subgroup also worked with and promoted the services, data and information products, and publications of the following library, information, and education groups:

- Access Excellence (Genentech, Inc. and National Science Teachers Association)
- Carbon Dioxide Information Analysis Center (U.S. Department of Energy)
- Consortium (now Center) for International Earth Science Information Network (CIESIN)
- Earth System Science Community Curriculum (National Aeronutics and Space Administration)
- Environmental Information Project (University of Minnesota and the World Wildlife Fund-U.S., Institute for Sustainable Communities, Center for Hazardous Materials Research)
- Global Change Research Inforamtion Office (CIESIN)
- Global Land Information System (U.S. Geological Survey)
- National Geospatial Data Clearinghouse (U.S. Geological Survey)
- Natural Resources Inventory (U.S. Department of Agriculture's Soil Conservation Service)
- World Data Centers/National Data Centers (National Academy of Science)

These examples of collaboration by librarians and libraries should be encouraged and supported. This is especially important for sharing the results of extensive research campaigns at levels of understanding for specific library audiences. It is however, going to be much more important for researchers and policy makers to utilize the full array of library services and capabilities to assist in changing, and changing dramatically, life styles at individual, family, community, corporate, state, national, and global proportions. Libraries and their information resource sharing networks and capabilities are established information infrastructres for the full management of data and information resources from their generation to their dissemination and archiving.

On an international level, the Internation Geosphere-Biosphere Program (IGBP) established more than 50 Regional Information Centres www.igbp.kva.se/regional.html (special research libraries, data centers, and information clearinghouses and centers) around the world. These Regional Information Centers are repositories for full collections of IGBP publications and have agreed to share these resources broadly. The concept of the RICs was made by the International Association of Technological University Libraries, a member of the International Council of Scientific Unions (ICSU).

Our government sponsored research is producing data at incredible rates. Further government support is converting this data into specialized data products and resources available on the Internet and other electronic media, and relying on increased high speed online platforms for the delivery of this information. Unfortunately, much of this data development is taking place with technologies that are strides ahead of the technologies available to many users for which these data are developed, converted, and produced online. Providing ALL libraries with the means to access and understand the data and information produced on account of global change research is an expensive undertaking. It is, however, most unfortunate that we have yet to provide an adequate answer to the question, "Where is the money going to come from?"

Public and private agencies, institutions, and organizations conducting research and developing policies must first set their respective agendas for continuing their efforts and develop the platforms and services necessary to gather, store, display, and disseminate the data and information resulting from their efforts. They must then find the means to support libraries and the library missions to share these repositories of data, information, and knowledge with the persons using libraries as a means for efficient, effective and equitable access to that information. This support should include grants for obtaining computer hardware and software, purchasing at reduced costs critical information resources for collections, training librarians on the availability and use of specific data and information resources.

Libraries and librarians have not traditionally been involved with the identification, acquisition, and dissemination of data, data sets, and data packages. Librarians are generally unfamiliar with the complex developments of these highly specialized data products and with the programs that produce and disseminate them. It was most encouraging to see librarians from the USGCDIS agencies and programs exhibiting their information and data products at the annual conferences of the American Library Association and to see some of these same agencies (EPA, NOAA, NASA, DOE, USGS, USDA/NAL) having their own separate exhibit presence.

It was equally distressing and disappointing to see the USGCDIS program loose its support for sending representatives to the ALA Annual Meetings beginning in 1999 and extending into the foreseeable future. As federal budgets have tightened, it is has been extremely difficult to attract the participation of federal agency librarians and staff to take part in panel presentations and speaker forums.

Continuing education and training of librarians with regard to the topics related to climate change and the resources and tools available, is an area needing support from global change research, policy, information programs, and from within the library community itself. Workshops at annual, regional, and local meetings of professional library associations and consortia are in the need of development and coordination at national levels. Continued publication of articles in scholarly and professional journals and magazines needs to be supported and encouraged. Development and promotion of online tutorials for librarians should be a priority for agencies producing the data and information resources.

Library schools offering the Master of Library Science degree or its equivalent do not provide specific graduate reference classes related to the environment and energy. These topics may be covered in more broadly defined graduate classes in Scientific and Technical Information, Government Documents, or general Reference instruction.

The only dedicated Environmental Information reference course offered in U.S. library schools was taught for more than 20 years by Dr. Marta Dosa, Professor Emerita in the School of Information Studies at Syracuse University, it is provided by Professor Dosa now only as an independent study elective. The Department of Library and Information Studies in the School of Information Science at the University of Buffalo will introduce a graduate reference course of the same title, Environmental Information, in the Fall 2000 Semester. The topics related to global climate change will definitiely be well-represented in this class.

A SUSTAINABILITY MODEL FOR LIBRARY INVOLVEMENT

Librarians in the U.S. have a unique opportunity to involve themselves in an interesting endeavor related to the issue of sustainable development. The American Library Association and Global Learning, Inc. received a $300,000 grant from the U.S. Agency for International Development to embark on a two-year program, Libraries Build Sustainable Communities. This program has been designed to help librarians learn about the multifaceted topic called "sustainability" and to demonstrate how libraries and librarians can be resources for long-term community sustainability and positive development.

This ALA initiative demonstrates how librarians offer the resources of the library and their own expertise to help residents of communities learn about sustainability and how communities might address these issues. A second and more dynamic aspect of this program demonstrates how librarians themselves can become active participants in the decision making processes affecting the communities in which they live and serve. To this end ALA identified 30 activities with which libraries and librarians can engage to increase community and librarian participation in the understanding of and participation in discussions about sustainability:

- Build collections on these subjects
- Develop reading lists on these subjects
- Conduct book reviews and discussion groups
- Hold video series
- Bookmark websites
- Utilize bulletin board/visual displays
- Conduct children's poster, poetry and essay contests
- Conduct literacy programs
- Host workshops
- Host public hearings
- Provide meeting space for community meetings
- Provide meeting space for community groups
- Visit local agencies working on these issues
- Initiate outreach to local issue-oriented groups
- Meet with local officials on these issues and offer the library's assistance
- Serve on boards of local agencies and organizations
- Help organize local agencies and organizations
- Compile and publish a directory of public/private agencies working on these issues
- Invite representatives from groups working separately on these issues to a meeting to discuss whateach can contribute to a holistic sustainable community
- Offer facilities as a neutral site to groups in conflict over community sustainability issues to mediate theidifferences
- Contact librarians in sister communities in other countries to see what community sustainability challenges they're facing
- Share this information through newsletter, bulletin boards, or website
- Establish sister library relationships in other countries
- Provide public access to information through the Internet
- Publish local information, e.g., sustainability indicators, on the Internet
- Provide public access to information through Geographic Information System (GIS) technology
- Conduct an energy audit and/or retrofit facilities to conserve energy
- Recycle paper, aluminum, glass…in ways to educate the public

- Identify and utilize the related expertise of trustees and friends of the library
- Demonstrate sustainable use and practices on library grounds

This ALA project can ***easily*** be re-directed to the topics related to global climate change. Just as the current ALA project teaches about issues related to sustainability, so a similar approach be used to share resources, ideas, and information related to global climate change.

LIBRARY PROGRAMS AND ACTIVITIES TO EXPLORE THE ISSUES OF CLIMATE CHANGE

A number of the above activities recommended by the American Library Association for increasing the understanding of sustainable development and for encouraging citizens (and librarians) to take more active roles in the decision-making process apply also to the topics related to climate change. The following comments are brief descriptions of SOME of the activities libraries can undertake to increase our understanding of the issues related to climate change, and provide convenient paths over, around, and through the barriers to communicating climate change information.

Scientists, researchers, policy makers, educators, and environmental managers should make concerted efforts to involve themselves in assisting libraries plan, implement, promote, and evaluate these activities. Much like their involvement with librarians in development of print and online collections of data and information, these same groups should be active partners with librarians in bringing the most scientifically accurate information base to the attention of the public at-large, in levels appropriate for understanding the complexities associated with climate change.

Such by-in by these groups lends to the importance of the topic, the credibility of the effort, and need for transforming our understanding into effective actions from individual to national and global levels. Collaboration and cooperation with libraries and librarians can provide unique opportunities for all parties involved. This level of outreach and networking will help facilitate appropriate understanding and use of the information generated by climate change research and policy initiatives.

Environmental Video Series:
View and discuss videos related to climate change, energy and environmental issues. Appropriate itles can be found from the following video distributors:

- Bullfrog Films — http://www.bullfrogfilms.com/
- Environmental Media: Media to Support Environmental Education — http://www.envmedia.com/
- Films for the Humanities and Sciences — http://www.films.com/
- Hawkhill Video — http://www.hawkhill.com/
- Media Basics Video — http://www.mediabasicsvideo.com/
- The Video Project: Media for a Safe and Sustainable World — http://www.videoproject.org/

Environmental Book Review/Periodical Article Discussion:
A single event or series held in the library. Librarians select book(s) and article(s) to be reviewed and discussed: set historical setting for the work's subject or content, background of author and previous and subsequent works, significance of book, the book in current perspective: how the work stimulated or sustained thoughts or activities about climate change.

Exhibits of Climate Change, El Nino/La Nina, Weather Forecasting, Energy Conservation, Renewable Energy Resources:
Exhibits can take the form of simple table-top displays , poster dispalys (NASA and NOAA have a rather impressive array of climate-related posters that make for attractive framed wall hangings), museum case displays of data productions and library resources, to actual on-site demonstrations of energy efficiencies (DOE and EPA program

offices and local energy utilities can be extremely helpful).

Environmental Lecture Series:
A more ambitious project of having local (state and national if possible or feasible) speakers representing different perspectives or constituencies of environmental quality, conservation, data and information resources (from books to the Internet), climatology and related Earth science disciplines. Individual speakers of panel participants would be drawn from:

- government agencies, departments, or bureaus
- elected officials
- colleges or universities
- environmental reporters/media personnel
- local business and industry environmental managers
- environmental education centers (museum, science centers, and teachers)
- local/regional professional organizations, such as:
  - American Chemical Society
  - American Meteorological Society (local weather forecasters and meterologists)
  - Air & Waste Management Association
  - Sea Grant and Agricultural Extensions
  - American Library Association and Special Libraries Association
  - American Geological Institute
  - Ecological Society of America
- nonprofit groups (especially speakers from local chapters of national environmental organizations):
  - Sierra Club
  - National Audubon groups
  - Trout Unlimited
  - National Wildlife Federation
  - The Junior League
  - League of Conservation Voters

Such lecture series could be provided as individual lectures over a period of time (brown-bag noon-time series, evening after-dinner series), panel discussions, or one-half day to full-day conference. Sponsorship and support could come from participating groups.

Sponsor Environmental Quality and Energy Efficiency Awards:
Provide recognition for outstanding service on behalf of environmental stewardship in taking positive actions to address the issues related to climate change. Awards would be given to a community leader, nonprofit organization, community group, student, teacher, organization, business, that has developed a noteworthy service, action, project, plan to address issues about climate change: environmental quality, sustainable growth, natural resources, habitat protection and restoration. A nominating panel can be made from librarians alone or involve other community groups and stakeholders.

Sponsor Home Energy Savings Workshops:
Libraries working with local power utilities, hardware stores, architects, and contractors and with state or county energy agency staff can conduct a workshop or lecture series (or for the ambitious library a demonstration project) for constructing or adding energy efficient features to an existing house (fuel sources [natural gas, electric, oil, wood], renewable technologies, wind power, insulation, solar [passive and active] energy, heating systems,

hot water tank insulation efficiency). Libraries could also provide a similar program for area small businesses.

The Environmental Reading Room:

A Saturday morning reading program for children (can be held at different K-12 levels) with book selections taken from fiction and non-fiction works allowing children to explore the world in which they live by studying the Earth's ecosystems, climate, and environments. Librarians would select readings and could themselves read book and lead discussions or could arrange to have teachers, community leaders, and others. In addition to children's books, age-appropriate videos, audio recordings, and other activities could be arranged.

Children's Environmental Poster, Poetry, Essay, Activity Contest:

Pick a theme and a panel of judges librarians and community leaders), invite students to submit their poster about the environment (work with individual schools and teachers), judge the posters, select winners (awards can range from simple ribbons and certificates to gift certificates or scholarship-type awards — depends how ambitious you want to get). Display ALL poster and feature winners. ❑

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APPENDIX 1

Selected library Web sites on climate change and related topics.

Atmospheric Sciences (University of Washington)
http://www.lib.washington.edu/subject/AtmosphericSci/

Center for Ocean-Atmospheric Prediction Studies Library (Florida State University)
http://www.coaps.fsu.edu/lib/reference/

Climate Change (University at Buffalo - SUNY)
http://ublib.buffalo.edu/libraries/units/sel/bio/ecochange.html

Climate Collection (University of California at Berkeley)
http://www.lib.berkeley.edu/EART/ClimateCollections.html

Climate and Environment in Africa (Columbia University)
http://www.columbia.edu/cu/libraries/indiv/area/Africa/climate.html

Climate and Weather (Universitiy at Buffalo - SUNY)
http://ublib.buffalo.edu/libraries/units/sel/sources/climateweather.html

Climatology on the Web (Longwood College)
http://www.lwc.edu/administrative/library/climate.htm

El Niño, La Nina, and ENSO Phenomena
http://ublib.buffalo.edu/libraries/units/sel/general/elnino.html

Lamont Doherty Earth Observatory Library (Columbia University)
http://www.ldeo.columbia.edu/library/index.html

Library Gateway (Cornell University)
http://campusgw.library.cornell.edu/
(go to "Networked Resources," enter keyword search, retrieve results)

NCAR Library (University Consortium for Atmospheric Research)
http://www.ucar.edu/library/

Polar Information Websites (University of Alaska)
http://www.gi.alaska.edu/services/library/polar_sites/index.html

Space Science and Engineering Library (University of Wisconsin-Madison)
http://www.ssec.wisc.edu/library/library.htm

International Climate Change Agreements (Pace University Law Library
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Regional Community Web Site

Jeanne Bisanz and Peter Sousounis

ABSTRACT

One of the most important components of our assessment is outreach, since our research is driven by our stakeholders' concerns. The Great Lakes Region Assessment (GLRA) community web site will provide a forum for these concerns, and an opportunity for stakeholders to seek answers directly from the researchers, as well as an provide an overall resource for climate change in the Great Lakes region.

The GLRA community web site will focus specifically on the needs of the Great Lakes area. It will be a small niche site that attracts a more specific, interested audience. "Stickiness," an internet term for building strong relationships with the site users will develop as the site community grows. The GLRA community site will create a place where members can interact with each other and develop their own content according to their own by using bulletin boards and featured chats. They may pose questions directly to GLRA team members and receive a direct response. Benefits include: researchers have the opportunity to develop direct relationships with stakeholders; this idea can be implemented over long distance (without travel); encourages communication and collaboration between the stakeholders and the scientific community. Ultimately, this communication will help ensure that what we produce (and research) is useful. ❑

Climatechangesolutions.com: A Study of How the Internet Creates Action

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Janet Sumner

ABSTRACT

CPS (www.climatechangesolutions.com) is Canada's emerging 'megasite' of success stories, tools and resources on how to reduce greenhouse gas emissions. I will present the web site development rationale, examples from the site and our analysis of users for the basis of my conclusion that active forms of communication such as the Internet create concrete action rather than simply awareness raising.

The presentation will cover the following areas:

1. *The Internet as an interactive communication medium, which in itself requires action*
2. *The rationale and evaluated response to the web site ww.climatechangesolutions.com*
3. *The design of tools on the Internet to create greater action from the user in a more active thought process than the passive nature of reading information*
4. *A discussion of communication vehicles and their results vis a vis passive, action or awareness. Why are pledges more effective than simply a brochure?*

The only other communication vehicle to date which possibly requires action on the part of the participant is a live workshop or conversation; whereas, using tools on the Internet is a virtual workshop if it is constructed correctly and potentially a virtual conversation if it is created as a portal site. Therefore, the Internet can produce the best results in percentages of people reached who take action over more passive forms of communication, which primarily raise awareness and do not facilitate action. Multiplying this by the audience growth potential, demographics and the user's openness to change on the Internet and it is clear that the Internet is a best possible choice for realizing action for environmental change. ❑

Session G3

CLIMATE CHANGE THROUGH INUIT EYES

Inuit Observations of Climate Change
Graham Ashford, Rosemarie Kuptana, and Dyanna Riedlinger
International Institute of Sustainable Development

Inuit Observations of Climate Change

Graham Ashford, Rosemarie Kuptana, and Dyanna Riedlinger

ABSTRACT

On Banks Island in the High Arctic, Inuit hunters and trappers live in close harmony with the natural world. As they travel over the tundra or harvest fish from the sea, they notice even the smallest changes to their environment. Recently, the changes have been more significantæand more worrying; the climate is warming, and the rate of change appears to be speeding up. Inuit are renowned for their ability to flourish in a harsh climate, to adapt as conditions change, to thrive where others cannot. Climate change poses a threat unlike any they have faced before. Their lifestyle and their culture may depend on their ability to adapt to this new challenge.

IISD's is working in partnership with the community of Sachs Harbour to help Canadians see through Inuit eyes. The goals of this projects are: (1) to produce a video which demonstrates to Canadian audiences, interest groups and decision-making forums that climate change is making an impact on the traditional lifestyles of and livelihood systems of Inuit on Banks Island; and (2) to understand the traditional knowledge of Inuit regarding climate change and to explore the contribution that traditional knowledge, local observation and adaptive strategies can make to scientific research on climate change in the Arctic.

To achieve these goals, the project first held a participatory workshop which enabled the Inuit to explain climate change from their own perspective. After the initial workshop, the project team traveled to Sachs Harbour three times through the year 1999-2000 to videotape climate change phenomena and conduct seasonal interviews, especially with people whose livelihoods are based on the land. The exact timing of these trips was determined by the Inuit themselves according to when they have observed the most significant climate changes. Through the scientific reports and video produced through the project, the value of Inuit observation and traditional knowledge has been demonstrated the three areas: direct climate change consequences, such as different ice formations and thicknesses; indirect climate change consequences, such as the appearance of new plant and animal species; and the adaptive strategies which the Inuit have developed to deal with these changes.

IISD is currently developing a communications strategy to convey the knowledge gathered through this project to the general public, decision-makers, industry leaders and scientists.

During this Session, the presenters will comment on the goals and methods used by the project, the community's perspective on climate change, and the integration of traditional knowledge in scientific research. A 45 minute rough cut of the video will be shown. ❑

Workshops

1. Climate Change in the Classroom - Beyond the Printed Page
Marnie Olson and Nancy Grenier
Greater Vancouver Region District

2. Bridging the Gap Between Tech Talk and Street Speak: Communicating to Non-Scientists
Ruth Edgett
WordBroker Communication Services

3. Creating a Climate for Change
Louella Cronkhite[1] and Cheryl Dash[2]
1. USC Canada
2. Alberta Government

4. Youth and the Internet
Heather Creech
International Institute of Sustainable Development

5. Climatechangesolutions.com: A Study of How the Internet Creates Action
Janet Sumner
Pembina Institute

6. Count Me In! A Workplace-Based Program to Raise Awareness and Stimulate Personal Action on Climate Change
Mari Komljanec
Enviros-RIS

1. Climate Change in the Classroom - Beyond the Printed Page

Facilitators: *Marnie Olson and Nancy Grenier*

A climate change education initiative that integrates print, electronic and direct delivery mechanisms. This session will reveal how to develop a program that is welcome in the classroom and communicates your interests.

Workshop Particulars:
- *EXAMINE the 'behind the scenes' of the Temperature Rising project – what worked and what didn't*
- *PARTICIPATE in examples of engaging activities*
- *DISCUSS the value of letting the needs of teachers and students shape your material*
- *DISCOVER ways to get your program into the classroom*

What will you take away from this workshop?
- *Resource material*
- *A recipe card of secret ingredients for the success of your next education program*

INTRODUCTION

A project that goes beyond the printed page offers the topic and issues a chance to become applied to other aspects of learning and life. When that topic is climate change, there is an opportunity for the learning to be ongoing.

This paper describes learned strategies for successful communication and education learned using the *Temperature Rising* resources as a model.

WHO?

The *BC Climate Change Communications Committee* (BCC4), an ad hoc group of government and non-government organizations, identified the need to communicate the information published in the *Canada Country Study* to secondary school students.

The information presented in Environment Canada's *1997 Responding to Global Climate Change in British Columbia and the Yukon* (Volume 1 of the *Canada Country Study: Climate Impacts and Adaptation*) became the basis of the *Temperature Rising* education resources.

During the summer of 1998, the project core group led by Environment Canada forged partnerships for the resource development, distribution and promotion of resources, and delivery of the teacher workshops. The group also secured funding through the Climate Change Action Fund.

The core group included Natural Resources Canada, Environment Canada, and Simon Fraser University. As the project evolved, the Greater Vancouver Regional District (GVRD) and Lord Tweedsmuir Secondary School became key partners.

WHAT?

The goal of the project is to reduce greenhouse gas emissions through education about climate change, its impacts and the choices to B.C. residents.

About the GVRD...

The Greater Vancouver Regional District (GVRD) is made up of 21 municipalities and one electoral area in the lower Fraser Valley, bounded by the Strait of Georgia to the west, the Coasts Mountains to the north, the Fraser Valley Regional District to the east, and the United States border to the south. About two million people live in Greater Vancouver.

The GVRD is a partnership of the region's municipalities which work together in meeting the needs of Greater Vancouver's residents. Its mission is to help protect the quality of life in the region and deliver regional services in an efficient and cost-effective manner.

GVRD Vision Statement

Greater Vancouver can become the first urban region in the world to combine in one place the things to which humanity aspires on a global basis: a place where human activities enhance rather than degrade the natural environment, where the quality of the built environment approaches that of the natural setting, where the diversity of origins and religions is a source of social strength rather than strife, where people control the destiny of their community, and where the basics of food, clothing, shelter, security and useful activity are accessible to all.

About the authors...

Nancy Grenier is a communications expert who became a member of the *Temperature Rising* core group while working at Environment Canada. She also chairs the education and promotion team and coordinates the publishing of the project Web site (www.climatechangecanada.org). Nancy is now working as the community relations coordinator for the GVRD. *Nancy can be reached at (604) 436-6862 and at nancy.grenier@gvrd.bc.ca.*

Marnie Olson is a certified teacher who develops curriculum for the GVRD. As an education coordinator, she facilitates professional development workshop for teachers. Marnie is involved with the development of the *Temperature Rising* resources through the education and promotion team. She is also involved in the development of the workshops and the teachers' resource kit. *Marnie can be reached at (604) 432-6396 and at molson@gvrd.bc.ca.*

WHEN?

The poster took about 15 months to complete (June 1998 to September 1999).

WHY SECONDARY SCHOOL STUDENTS?

We want to reach an audience that is likely to apply an understanding of climate change to daily life. Our research reveals that students, especially those at the secondary level, are the segment of the population most likely to act on the information they receive.[1]

The *Temperature Rising* resources are designed for secondary school students because they are preparing to make lifestyle and consumer choices as adults. Youth are regarded as the decision makers of the future and great hope is placed in their hands to solve long-term problems and issues in the world.

Climate change is such an issue-it is worldwide and gradual as it impacts over time. There is an opportunity to communicate information and messages about climate change to this audience.

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[1] Angus Reid Survey, 1995.

Students are also a large group of individuals already organized within a structure for learning-the formal education system.

The controversial nature of climate change and its popularity mean that "everyone is talking about it" but not everyone "knows" about it. This includes teachers, as well as students.

Offering current, relevant and accurate information, as well as student activities to teachers means the subject of climate change may be selected and integrated into classrooms as a means of addressing curriculum requirements.

WHERE?

The *Temperature Rising* resources cover the science of climate change with reference to the potential impacts for the southwestern region of B.C.

HOW WERE THE RESOURCES DEVELOPED?

The *Temperature Rising* resources illustrates that scientific information combined with inclusive communications coordination form the basis of a successful project that can reach secondary school students in a meaningful and lasting way.

The success of the *Temperature Rising* project is attributed to many factors beyond producing a poster-or a printed page.

Throughout the development of the resources, the *Temperature Rising* project partners had something unique to contribute, and much to gain through their involvement.

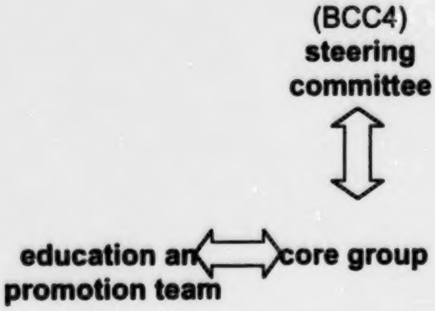
The BCC4 became the "steering committee" for the project.

This group, made up of more than 20 organization representatives, agreed to three key messages for the poster and its accompanying resources:

1. climate is changing
2. climate change presents risks
3. specific activities contribute to climate change

During the development of the *Temperature Rising* resources, the steering committee acted as a pool of "specialists"

Temperature Rising
Information flow of development process



or "experts" to review specific components of the resources (i.e., forestry, fisheries, agriculture, etc...). Each expert approved content related to his or her field to ensure accuracy.

The teachers' kit, its promotion and the Web site maintenance continue to be developed by the members of the "core group." This group also continues to be involved with the development of additional *Temperature Rising* resources.

To date, the work completed by the core group includes:
- writing the poster content
- selecting and creating images
- developing the concept of the poster layout
- integrating the feedback from the steering committee and other advising groups such as the education and promotion team
- ensuring resources are scientifically accurate

A second group, the "education and promotion team" was made up of educators, teachers, communications experts, students, government and non-government organization representatives. Some members of the team were working on other climate change education projects, so co-promotion and co-delivery opportunities were identified early.

The education and promotion group contributes:
- ongoing feedback about the *Temperature Rising* resources (content, presentation, writing, promotion and distribution)
- development of a teacher resource kit
- design and delivery of teacher workshops (through the GVRD)
- links to teacher and educator networks for the evaluation of the resources (i.e., poster and teacher resource kit prototypes)
- development and ongoing maintenance of the *Temperature Rising* Web site
- promotion of the resources through teacher magazines, conferences, and other education networks

HOW DO EXPERTS CONTRIBUTE TO THE PRODUCTION OF EDUCATIONAL RESOURCES ON CLIMATE CHANGE?

The collaborative model implemented in the *Temperature Rising* project brings together four key roles-the skills and expertise of scientists, communicators, educators and comments from students.

The scientist contributes expertise in...
- providing accurate, unbiased and current scientific content
- communicating the science and potential impacts of climate change on local and regional scales
- explaining the uncertainties in prediction
- knowing how science is accepted by other scientists-current issues for environmentalists and skeptics (i.e., what aspect of climate change is real, reasonable forecasting of what is to come...)

The communicator contributes expertise in...
- managing projects and coordinating production
- defining structure of work teams-who do we need to do what? (finding the strengths of contributors)
- identifying and involving stakeholders in different phases of the project (production, evaluation of prototype, distribution, etc...)

- helping define scope of project-commitment to production, delivery and promotion of pieces (i.e., Web site for five years? Teacher workshops for two years?)
- ensuring information is conveyed among project team members
- maintaining momentum and focus of work teams
- defining concepts of key messages and developing these messages
- promoting the resources
- coordinating evaluation and distribution of material

The teacher contributes expertise in...

- knowing what the audience wants
- making resources useful to teachers and meaningful to students
- developing student-ready resources to assist teachers with implementation and classroom delivery (teachers' resource kit)
- knowing how best to deliver the resources to teachers
- motivating students to discuss and to engage in critical thinking (as these skills relate to the provincial curriculum requirements at all grade levels)
- identifying connections between the resources and the B.C. Ministry of Education prescribed learning outcomes
- clarifying content for relevance and comprehension
- engaging learners in a topic

The students contribute opinions on...

- whether the information is easily understood and applicable to their life
- their level of interest in the topic
- the format of the information (i.e., layout, design and graphic)

HOW DO WE GET RESOURCES INTO SCHOOLS?

By invitation only!

...And the best way to be "invited" into schools is to produce resources that are based on the needs of teachers and students.

Common barriers hindering effective climate change communication in the classroom...

- the topic is "big" and the information is overwhelming
- time required to read all the information available and develop meaningful student activities
- non-science teachers' information needs are different
- need for activities that address different learning styles
- shortage of resources that have opportunities for discovery
- limited curriculum topics stating climate change
- many other topics to cover during the school year
- assumption that teachers have a background in climate change

WHY AREN'T ALL TEACHERS TEACHING ABOUT CLIMATE CHANGE?

Don't they know how important it is?

Maybe not. It's not unusual for a teacher with a specialty other than science or social studies to teach science subjects. And "telling" teachers a topic is important isn't going to inspire them.

Imagine the additional resource requirements that a non-science teacher needs in order to deliver a topic such as climate change. However, "additional resource requirements" does not mean more background information. The *Temperature Rising* resources give teachers more tools. Too much information reduces their interest and increases their frustration.

WHY NOT PROVIDE AS MUCH INFO ABOUT CLIMATE CHANGE AS IS AVAILABLE?

...Why limit the content?

Providing all the information in the resources is not only overwhelming for the teacher, it also limits the access to current and future opportunities for research.

More information about the topic needs to be available-but only when teachers and students are ready for it. This is often only after a student has worked through some general knowledge and applied it to thought-provoking activities.

Adopting a "timeless approach" to information means inviting teachers to seek more information and providing a place to find it. The Web can offer content updates, new ideas for activities as well as an interactive stream to help teachers share information about ideas, activities and local initiatives.

Carefully designed, the resources can have a "career" shelf life because scientific data can be compared with new data as it becomes available. For example, today's data can be used in tomorrow's discussions. Students will assess what has changed, and predict what these changes mean for the future. In addition, teachers can use the activities throughout their career because the teaching approaches do not become outdated.

How much information should be provided in the resources?

Ask questions such as:

- Is this important to the audience?
- What is the best method to deliver to this audience?
- What would a teacher need in five years?
- Is this a career resource? (If not, what is the shelf life of the resource?)
- What is in the future of this program?
- What can we afford to deliver?

WHAT DO TEACHERS LOOK FOR IN A RESOURCE?

They seek resources to enhance their work.

The *Temperature Rising* resources are meaningful and interesting to students. Activities are engaging and use a variety of creative approaches to explore the topic. In order for students to complete a task, they must apply an understanding of content. This is the basis of meaningful learning.

Teachers have the professional skills to develop resources but they are challenged by the need to cover an overwhelming number of topics during the school year. The key is to produce resources the same way teachers would, if they had the time.

Teachers are given the authority to select what resources they use to meet the curriculum requirements of the B.C. Ministry of Education. Most of the curriculum links to climate change refer to the topic as only one of many options teachers can choose. If we produce resources with only our own interest in mind, teachers will select a topic or issue they are more comfortable with-and there are many topics significantly less daunting than climate change!

Understanding and listening to teachers reveals that they appreciate student-ready activities. The *Temperature Rising* resources are welcomed in the classroom because the activities are not only student-ready, but they are also based on the B.C. Ministry of Education **principles of learning** that teachers are expected to follow.

The B.C. Ministry of Education Principles of Learning

- Learning requires the active participation of the student.
- People learn in a variety of ways and at different rates.
- Learning is both an individual and a group process.

Some teachers would like to integrate climate change into their classroom but, for them, the topic is "too big," "too complicated," and "too scary."

Our experience is that teachers are also greatly interested in the *Temperature Rising* resources because of the local content. The B.C. Ministry of Education recommends that teachers use resources that focus on local aspects of a topic to help make learning relevant to students.

If we want teachers to use our resource, it needs to be helpful. By understanding the importance of curriculum links, local and relevant information and engaging activities, a program that is welcomed in the classroom can be developed.

WHAT DOES AN ENGAGING ACTIVITY LOOK LIKE?

An engaging activity is **open-ended** and offers students opportunities to learn through tasks that require problem solving and **critical thinking** skills.

Teaching Terms

open-ended

questions or activities that allow for a creative and unique response or perspective by each learner (i.e., not only one correct response)

critical thinking

tasks that require the learner to seek many possibilities and evaluate each for the purpose of drawing conclusions

experience-based

learning that requires active participation

The *Temperature Rising* resources engage students in activities that are **experience-based**. For example, one activity requires students to be part of a creative film production crew. They are tasked with developing four climate change visuals to deliver key messages to the public through television and present their concept sketches. Students find this approach fun and interesting.

Some students will demonstrate skills and understanding about the topic because they respond to the opportunity to present their ideas in a visual form. Others will "shine" during the presentation portion. The rest will perform their best because they like to work "behind the scenes" developing key messages, as part of team.

In this activity, students experience meaningful learning by:

- gathering relevant information
- analyzing the information
- interpreting the data
- evaluating its relevance

- articulating opinions
- presenting ideas
- debating their position
- summarizing the information to form the key ideas for the visuals
- illustrating their comprehension
- organizing a presentation
- presenting their results

As far as content is concerned, all students need to know the facts of the climate change and the issues to complete their tasks.

HOW DO TEACHERS LEARN ABOUT THE BENEFITS OF RESOURCES?

The GVRD delivers a *Temperature Rising* professional development workshop that provides teachers with an opportunity to try some student activities and to learn, first-hand, how the resources can help them. Teachers also discover that a science background isn't required to teach about climate change.

The *Temperature Rising* workshops illustrate interesting and intriguing approaches and offer opportunities for discovery and reporting of findings in creative and captivating ways. The workshop provides teachers with a forum to share professional perspectives on engaging students in activities while learning more about the topic. When they return to the classroom, teachers are equipped with direct experience, ideas and support materials for their climate change programs.

Promotion ideas-that work!

- Write articles for teacher publications (i.e., Green Teacher, and teachers' federation newsletters).
- Distribute promotional pieces at conference displays.
- Offer workshops.
- Work with other environmental or education networks.
- Distribute a one-page flyer and send resources upon request.
- offer FREE resources.

WHY IS THE GVRD INVOLVED?

The GVRD is committed to raising awareness and providing suggestions to Lower Mainland residents on how they can reduce their impacts on air quality and climate change. These are aspects of an ongoing public education program on urban issues such as growth management and development planning. This GVRD program enhances the existing environmental education programs for teachers and other educators in the region.

WHAT'S IN IT FOR YOU?

A resource that reflects the needs and interest of students and teachers is welcomed in the classroom. Resources need to introduce opportunities for participants to consider the impact of their lifestyle and the choice they can make to benefit the environment. Your messages are relevant to people when they are making these decisions.

THE FIVE TEMPTATIONS...

Lessons learned...

Temptation 1: Education resources need to be everything to everyone.

The *Temperature Rising* resources are designed to support grade 10, 11 and 12 curricula. With the development of a teachers' resource kit to make the poster and its messages (content) relevant to students, activities that facilitate "discovery" are not only timeless, but can be adapted easily to lower grades. Interestingly, elementary school teachers are enthusiastically requesting the resources for integration into their classrooms.

Temptation 2: Climate change knows no boundaries and its magnitude can only be understood if it is presented on an international scale.
Students, like adults, are much more receptive to information about what's happening in their backyard, in their neighbourhood or city. The potential impacts of climate change on the southwest region of B.C. are numerous so we were able to focus the information on this region. This is not to imply that no other region is subject to impacts of climate change. The purpose is to keep the information local. In addition, students will be exposed to information about climate change through other sources such as the news media or discussions with friends and family.

Temptation 3: Develop climate change material in isolation to keep the project simple, the timeline short, and the budget manageable.
The result could be scientifically inaccurate and irrelevant to teachers! Bring key players to the table. Involve teachers and students in the resource development process (i.e., pilot testing). The best way to know what teachers need is to ask them! You may also be surprised at the cost effectiveness of bringing strategic partners together.

Throughout the development of the *Temperature Rising* resources, partners offered expertise along with delivery mechanisms, distribution channels, and incredible networks to successfully promote resources and teacher workshops. An inclusive process requires longer timelines, but the benefits will outweigh invested time.

Temptation 4: Produce a poster as a complete classroom resource.
Consider creating and maintaining a Web site where teachers and students can go to get more information, or news about recent developments. As its name implies, climate does change-and so do the ways we perceive and deal with the impacts it has on our life. Also, once you get a teacher's interest in your resources, make sure you are prepared to offer them support or more information when they ask for it. After all, isn't this what *you* want? Could you ask for more than teachers calling *you* for information about climate change?

Temptation 5: Distribute the resources to every school to reach students.
Instead of doing a mass mailout to librarians, principals or "science department heads," promote the resources through conferences, teacher newsletters and other trade publications. Develop a promotional piece (e.g., a postcard, a one-page flyer) to promote your resources, and provide a contact number to order the material.
Teachers will only request, and use, resources that meet their needs and interests. Meeting this requirement will not only generate the requests for your materials, it will also ensure the resources are welcomed in the schools. From the orders placed by teachers, you may develop a mailing list that can become an invaluable tool for the evaluation of your resources.

SECRETS TO SUCCESSFUL EDUCATION RESOURCE DEVELOPMENT...

These secrets reflect the authors' experiences with the development and delivery of the *Temperature Rising* project, as well as a series of other environmental education programs delivered to teachers of 11 school districts in Greater Vancouver.

- understand and listen to your audience
- develop material with the audience in mind
- avoid the temptation to "show and tell" everything
- identify the long-term benefits to having students "learn" instead of "know"
- prepare for long-term, rather than immediate, "results" from education
- find ways to help students generate questions rather than just answering yours
- provide opportunities for students to investigate and evaluate all sides to a story (i.e., to challenge the science or

form arguments through research that may actually differ from your organization's position)

- provide connections to other information and resources
- offer resources to teachers for free
- provide a Web site address or contact phone numbers to facilitate teacher or student access to more information
- let students make their own conclusions
- "pilot" test your material with teachers and students and apply their suggestions. ❑

2. Bridging the Gap from Tech Talk to Street Speak: Communicating Science to Non-Scientists

Facilitator: *Ruth Edgett*

ABSTRACT

This is an intensive 2 1/2 hour workshop. Its goal is to help scientists and specialists become more self-sufficient in getting their messages across through the media. Participants will learn some basic principles of communicating with non-scientific audiences, and about working with the people inside their own organizations to help ensure internal support for their communication efforts. Participants will be introduced to the "Five Steps from Tech Talk to Street Speak"; they will be taken through some basic steps in working and communicating with the media; and, finally, they will be given some pointers in developing communications strategies. There will be writing exercises to help participants clarify their thoughts, understand how to capture the interest of news media, and improve the accuracy of media reporting. Workbooks used during the session may be kept for future reference to guidelines and ideas. ☐

3. Creating a Climate for Change

Facilitators: *Louella Cronkhite and Cheryl Dash*

As part of a 5-year strategy culminating in Alberta's centennial anniversary in 2005, the City of Lethbridge Environment Week Committee has developed school-based activities and an awareness campaign dealing with Climate Change. The strategy focuses on improving understanding and awareness of issues relating to and around climate change. The goal is to foster a change in attitude, promote informed decision-making, and develop relevant responses amongst students, businesses and the community.

> The world we created today
> as a result of our thinking thus far
> has problems which
> cannot be solved by thinking
> the way we thought
> when we created them.
> – *Albert Einstein*

COMMUNITY CHALLENGE

Climate change is what many believe to be the 'issue' of the new millennium. The Lethbridge Environment Week Committee feels that over the next five years we need to bring this issue front and centre to the public's awareness and focus efforts on changing attitudes and promoting change in practice.

Mission: *Through community events and information distribution, encourage environmentally positive personal actions toward improving the environment throughout Southern Alberta.*

Community events such as the annual Environment Week Festival will be one of the methods used to inspire people within the community to participate at a level appropriate level for them and help to draw a connection between our actions and the health of the environment.

One of the goals of the committee is to work with local youth and schools to participate both before and during the annual event. In early April of 2000, members began to design and write a curriculum based classroom program focussing on climate change, greenhouse gases and desertification – Creating A Climate for Change. The program has been piloted in six grade five classes over a series of five weeks in early May leading up to the environment festival.

OBJECTIVES OF THE SCHOOL PROJECT

1. To provide balanced information to grade five students about the local and global implications of Climate Change.
2. To produce a series of activities that fulfills Grade 5, Topic D: Weather Watch, General Learner Expectation 5-9 of the Alberta Science Program of Studies, ie., Investigate interactions between weather phenomena and

human activity. Students will be able to:

- understand that climate refers to long term weather trends in a particular region and that climate varies throughout the world,
- recognize that human actions can affect climate, and identify human actions that have been linked to the greenhouse effect.

It is anticipated that this mini-unit will also meet curricular demands in other provinces under the pan-Canada Science framework.

3. To motivate positive behaviour change at the individual, school, and community level among grade five students, through the Environmental Heroes program, participation in the Lethbridge Environment Festival (held in June each year), running school audits, and making personal commitments to take action to protect and preserve the environment.
4. To print and distribute copies of the resource. The resource will be published in both English and French, and will be available in print and over the internet for teachers across Canada.
5. To design a teachers' professional development workshop, to present at conferences and conventions in school year 2000-2001
6. To promote partnerships between agencies in Lethbridge and Alberta.

PEDAGOGICAL APPROACH

One of the goals of this project is to provide "a climate for change" – a classroom atmosphere and approach which encourages learning, dialogue, and experiences in the realities of climate change. New information is available daily. Students who have a solid understanding of the fundamentals of climate change, who know where to find current information, and who can draw connections between such seemingly unrelated topics as desertification, climate change, pesticides, and having a long hot shower will feel comfortable continuing to explore the ideas and issues around climate change.

The "climate for change" designed into this teaching resource is contained in the weekly activities, which are:

- Participatory. All students are able to make contributions to the discussion or activity;
- Interactive. Teachers and students learn together through dialogue and through the use of computer technology;
- Knowledge based. Numerous current resources are available for accurate information on the science of climate change;
- Outcome oriented. Opportunities are provided for the students to make a personal commitment to take action in reducing CO_2 emissions; to consider the characteristics of an environmental hero and to nominate individuals whom they believe qualify; and to participate in the Environment Festival; and
- Relevant. Examples are drawn from both the students' experience and the wider world. The global web of interconnections and of cause/effect and solutions are examined.

WEEK BY WEEK ACIVITIES

Activity 1: *The Heat is On*

An introduction to global climate changeIn the first week of May, six grade five classes at four Lethbridge schools were amazed to see a huge game wheel being carried into their classrooms. Students were quickly grouped to play *Who Wants to Be an Environmental Hero*, and could spin the wheel to determine whether their group's climate change question would be on *The Global Picture, Human Influences, Climate Science*, or *Fact or Fiction*. Students received *Environmental Hero* nomination forms, and began to discuss criteria by which they might nominate someone in their class or school to be an environmental hero.

Activity 2: ***World in a Bottle***
In week 2, students created a *World in a Bottle*. Gravel, charcoal and soil lightly mixed with sand were carefully layered in a large jar, into which plants were nestled. A light mist provided the needed rainfall, and the jar was closed up and set in a window - but not where the sun might be too intense. This model of the earth and its atmosphere - a closed system - would be observed over the coming weeks.

Activity 3: ***The World Wide Web: The Internet***
By week 3, the students were beginning to understand the consequences of increased CO_2 in our atmosphere. A hands-on exploration of kid-centred web sites on climate change and desertification led students to make practical commitments to personal, family and school action to reduce CO_2 emissions.

Activity 4: ***The World Wide Web: Human Interactions***
In week 4, *The World Wide Web: Human Interactions* took the students to Mali, West Africa where they learned the causes of desertification, both natural and human, and the effects the loss of productive soils has on the people who depend on it for their livelihood. Students watched the USC Canada video, *Challenges in Arid Lands*, where they learned of the many projects people have developed in Mali to combat desertification. They saw how students at a school in Gono, Mali plant trees in their school yard, creating an arboretum of indigenous species. This project not only provides a focus for environmental education in the school; it also creates a green, shady space in an otherwise dry environment, demonstrating the value of retaining and planting trees. Neighbouring villages visit the arboretum, where students explain the benefits of the particular species of tree and how to create similar arboretums in other locations. (French Immersion students at Agnes Davidson School recall receiving letters and hand-made bracelets from the students at Gono School last year. In return, they collected school supplies and wrote letters to Mali.)

Activity 5: ***Choose Your Challenge***
In the final week of the project, students drew together what they had learned and completed their nominations for environmental heroes. By now, they know not only what actions can help make a difference; they also know why those actions make a difference and what the science is behind climate change and desertification. They have the tools to become environmental heroes!

Complete instructions for leading these activities in the classroom, including an annotated list of relevant web sites and background readings, will be printed for teacher use in both English and French.

PARTNERS WITHIN THE COMMUNITY

The USC Canada/Alberta office has been working with Lethbridge-area schools over the last three years to build awareness of desertification as it affects both Alberta and countries such as Mali in West Africa. Desertification is both a cause of climate change and a result of increasing temperatures and decreasing precipitation. Most of the causes of desertification are human - deforestation, overgrazing, improper irrigation, and poor farming practices - and this is true both in Alberta and in Mali.

School project partners to date include: Alberta Environment, the City of Lethbridge, USC Canada, the Helen Schuler Coulee Centre, Chinook Health Region – Population Health, Southern Alberta Environmental Group, Lethbridge School District #51 and the Holy Spirit Catholic School Division. Local businesses, organizations and groups will be invited to a fall meeting to become involved in building a sustainable community committee in Lethbridge and be a part of the community project over the next five years. ❑

PARTICIPATING SCHOOLS

We would like to thank the following schools and teachers for allowing us to be part of their classrooms for five one-hour sessions. Our timeline was short and they were most accommodating.

- Agnes Davidson School, Carolle Babin, French Immersion

- Our Lady of Assumption School, Bruce Lajeunesse, two classes
- Fleetwood-Bawden, Jennifer Parkinson, two classes
- Senator Buchanan, Betty Carney

This school project – *"Creating A Climate for Change"* – was designed, developed and piloted in the classroom by:
Cheryl Dash, Alberta Environment, Lethbridge, Alberta
Louella Cronkhite, USC Canada - Alberta Provincial Coordinator, Lethbridge, Alberta
Lynsay Smith, Helen Schuler Coulee Centre, Lethbridge, Alberta
Angele Champagne, University of Lethbridge Student, Lethbridge, Alberta
Debby Gregorash, Southern Alberta Environmental Group, Coaldale, Alberta

4. Youth and the Internet

Facilitator: *Heather Creech*

ABSTRACT

We know that 64% of Canadians between the ages of 16 and 30 have Internet access and use it as much for studies as they do for entertainment. This is their technology, their medium: how can it be employed to inform and challenge young Canadians to change lifestyles and expectations, and how can it connect them to international youth experience, impacts of climate change and opportunities for action? The workshop agenda will be developed, and the workshop itself facilitated by a small committee of young people who have worked with IISD on its Youth Strategy for Public Outreach on Climate Change – a report to the Public Education and Outreach Issues Table.

Workshop structure:
- *Exploration of key issues and challenges for Internet communications with youth*
- *Breakout groups to generate ideas on possible projects*
- *Reconvene to review project ideas and discuss measures of success*

Anticipated outcomes:
- *Improved understanding of the limitations and strengths of Internet communications for engagement and lifestyle change*
- *Draft indicators of successful Internet communications for climate change*
- *Potential pilot projects* ❑

5. Climatechangesolutions.com: A Study of How the Internet Creates Action

Facilitator: *Janet Sumner*

ABSTRACT

Climate Protections Solutions (CPS) (at www.climatechangesolutions.com) is Canada's emerging 'megasite' of success stories, tools and resources on how to reduce greenhouse gas emissions. I will present the web site development rationale, examples from the site and our analysis of users for the basis of my conclusion that active forms of communication such as the Internet create concrete action rather than simply awareness raising.

The workshop will cover the following areas:

1. *The Internet as an interactive communication medium, which in itself requires action*
2. *The rationale and evaluated response to the web site ww.climatechangesolutions.com*
3. *The design of tools on the Internet to create greater action from the user in a more active thought process than the passive nature of reading information*
4. *A discussion of communication vehicles and their results vis a vis passive, action or awareness. Why are pledges more effective than simply a brochure?*

The only other communication vehicle to date which possibly requires action on the part of the participant is a live workshop or conversation; whereas, using tools on the Internet is a virtual workshop if it is constructed correctly and potentially a virtual conversation if it is created as a portal site. Therefore, the Internet can produce the best results in percentages of people reached who take action over more passive forms of communication, which primarily raise awareness and do not facilitate action. Multiplying this by the audience growth potential, demographics and the user's openness to change on the Internet and it is clear that the Internet is a best possible choice for realizing action for environmental change. ❑

6. Count Me In! A Workplace-Based Workshop to Raise Awareness and Stimulate Personal Action on Climate Change

Facilitator: *Mari Komljanec*

The Climate Change workshop is a 2 hour interactive workshop for staff of companies, government agencies and organizations interested in increasing employees' awareness of the climate change issue. The workshop is intended to encourage individuals to make commitments to undertake individual actions to reduce their own greenhouse gas emissions at home, at play and while travelling. Unlike many environmental communication and education efforts that focus on awareness building alone, this workshop focuses on personal action.

CLIMATE CHANGE WORKSHOP

Individual Canadians account directly for approximately 40% of Canadian greenhouse gas emissions. Our per capita greenhouse gas emissions (mostly associated with energy use) are amongst the highest in the world. The 2-hour Climate Change Workshop is intended for staff of companies, government agencies and organizations interested in increasing employees' awareness of the climate change issue. The workshop addresses the emergent and increasingly important environmental issue of climate change, providing scientific background information that builds understanding amongst average Canadians, while focusing primarily on the critical role individual Canadians play, and how they can make a difference in the issue.

The workshop is highly interactive, and uses a game to facilitate learning about energy efficient options available to individuals. The interactive aspects of this workshop have set it apart from other education and outreach initiatives. It is overwhelmingly reported to be fun, and more importantly, engaging in facilitating learning.

The training program focuses on ACTION, and on building the circumstances, the motivation and understanding for participants to act and to make a difference. Energy saving or climate friendly actions, no matter how small, are encouraged as the outcome of the workshop.

The workshop includes 3 main parts:

1. The Need to Know - the basic science of climate change
    - a warm-up exercise that asks participants to share their own perceptions of what climate change/global warming is;
    - a 20 minute lecture about the primary causes and projected impacts of climate change (compels participants to take the next step; i.e. to learn what they can do about the issue);
2. Interactive Activity - potential actions & their impacts
    - an activity that allows participants to actively evaluate and then choose the most energy saving measures based on the relative ease or difficulty of implementation, and the relative amount of energy savings (or climate change benefit);
    - an individual exercise that asks participants to select which measures they can realistically accomplish and what the cumulative impact of these measures is;
3. A Call to Action - the Pledge

- an inspirational message intended to illustrate that it is possible for individuals to collectively make a difference and contribute to adoption of new social norms (counters scepticism about people not being able or willing to change);
- a voluntary pledge which offers participants the opportunity to undertake small, realistic actions, appropriate for their own circumstnaces, which will start them on the road to increased energy efficiency;
- introduction of a monitoring program to calculate the greenhouse gas savings per individual, company and for the whole program, and to report this information back to all workshop participants to remind them of their commitments. Participants report back on their accomplishments and are recognized for their efforts. This approach also enables the program sponsor to maintain ongoing contact with workshop participants.

In its entirety, the workshop addresses the following key issues:

- It imparts a basic understanding of what climate change is, the primary causes and potential impacts
- It emphasizes that individual Canadians have a role to play, and that we can each make a difference in the issue
- It focuses on ACTION on the issue (i.e. it goes beyond mere awareness or understanding of the issue)
- It introduces participants to a broad range of energy saving (or climate friendly) actions
- It imparts an understanding of the relative impacts of our daily actions on greenhouse gas emissions (i.e. does such and such an activity impact significantly on climate change or not?)
- It recognizes that Canadians already have very busy lifestyles, and that the changes that each of us can realistically incorporate into our lifestyles will be different for all of us, depending on our circumstances. This is critical, as an important element of the workshop is the follow up monitoring to assess whether participants have been able to sustain behaviour changes committed to at the workshop.

In summary, the learning activities in the workshop have been carefully developed to encourage a high degree of participant engagement and discussion concerning the implications of the climate change issue on their own lives. The more participants consider potential actions, in their own terms, the more likely participants will be motivated to take action.

This successful education program is expected to result in reduced individual emissions of greenhouse gases nationwide (and partial mitigation of the climate change issue), but will also contribute to a better understanding of the capacity and willingness of Canadians to take steps to reduce emissions (which will be useful for governments and other organizations working on public outreach efforts and other public policy instruments).

At the time of printing, 118 workshops had been delivered to a total of almost 2,400 working Canadians*. On average, each workshop participant pledges to reduce roughly two tonnes of greenhouse gases through the national pledge. If every working Canadian were to pledge a similar amount, it could total potential greenhouse gas savings of over 20 million tonnes (a significant contribution towards Canada's Kyoto commitment)! ☐

* *Includes results of CMI workshops delivered through both the Count-Me-In and Action By Canadians programs.*

Public Forums

PUBLIC OUTREACH EVENTS TO RAISE AWARENESS OF CLIMATE CHANGE IN THE LOCAL COMMUNITY

Evening Communication Showcase

The Climate Change Challenge: Impacts and Adaptation
Paul Egginton
Director, Terrain Sciences Division, Geological Survey of Canada, Natural Resources Canada

Growth, Grandchildren and the Greenhouse Effect
Ralph Torrie
Smith Torrie Associates

Sondaky
Native Canadian Musical Group
Quebec

Educational Event for Youth

"Global Warming Happened So Fast"
WPIRG Action Theatre
University of Waterloo

Global Warming, Hot Times Ahead
Churchill Films

Sondaky
Native Canadian Musical Group
Quebec

Evening Communication Showcase

The Climate Change Challenge: Impacts and Adaptation

Paul Egginton

Scientific theory and supporting evidence suggest that changes in the greenhouse effect will have a significant effect on all aspects of climate. Although there is uncertainty about the magnitude of future climate change, the fact that our climate is changing is real and its effects are with us already. To limit the negative impacts, we have two main responses: mitigation and adaptation. Mitigation efforts are a precondition for the success of adaptation strategies, because adaptation is more likely to succeed if climate change is kept to a moderate pace and human pressures on the climate system are eventually stabilized. ❑

Growth, Grandchildren and the Greenhouse Effect

Ralph Torrie

While Canadian policy-makers focus on reducing greenhouse gases by six percent over the next ten years, climate science shows that the actual target should be 50 percent or more. Anything less will not stabilize atmospheric concentrations, and prevent dangerous interference with the climate. This article explores possible explanations for this "gap" in the policy response to climate change, and previews results of a scenario analysis on how Canada could reduce its greenhouse gas emissions by 50% over the next thirty years. ❑

Sondaky

Native Canadian Musical Group

Sondaky is a native Canadian musical group from the Province of Quebec, performing under the leadership of Gaetan Sioui. The production of this unique show includes 11 artists on stage—live music, choreography, spectacular dancing and costumes. The show is based on the group's belief that it is time to care for Mother Earth and preserve all those natural elements that give us life. It is time to give a better heritage to our children. ❑

Educational Event for Youth

"Global Warming Happened So Fast"
WPIRG Action Theatre

Global Warming Happened So Fast" - a special production of "Action Theatre", a troupe of students from The Waterloo Public Interest Research Group (WPIRG). They will be using traditional and alternative theatre to entertain and covertly educate the masses. They'll get some help from the Phantom of the Fossil Fuels. ❑

Global Warming, Hot Times Ahead
Churchill Films

The video, "Global Warming, Hot Times Ahead" is produced by Churchill Films and distributed in Canada by McIntyre Media Ltd. This 23-minute production, hosted by "Family Ties" television star, Marc Price, is aimed at young adults. It highlights the links between everyday decisions and global environmental conditions, and shows what you and I can do to slow it down. ❑

Sondaky
Native Canadian Musical Group

Sondaky performed during the Evening Communication Showcase as well.

Poster Papers

ABSTRACTS OF CLIMATE CHANGE POSTERS THAT WERE PRESENTED AT THE CONFERENCE

Experimentally Flooded Reservoirs: Using Stable Carbon Isotopes to Investigate Sources for Greenhouse Gas Production

N. Boudreau[1], S. Schiff[1], V. St. Louis[2], E. Joyce[2], D. Bodaly[3], R. Aravena[1], and R. Elgood[1]

1. University of Waterloo
2. University of Alberta
3. Department of Fisheries and Oceans

Resilience and Adaptation: Social Systems, Coastal Communities, and the Challenge of Climate Change

Jodi Browne

University of Waterloo

Identification of Links Between North American Prairie Snow Cover and Atmospheric Circulation

C. Derksen,[1] E. LeDrew,[1] A. Walker,[2] and B. Goodison[2]

1. University of Waterloo
2. Environment Canada

Connecting Climate Change to Local Environments along The Great Lakes

Patrick Donnelly and Geoff Peach

Lake Huron Centre for Coastal Conservation

Communicating Climate Change Issues To The Public Through Television Media

Rick H. Haupt[1], Gordon Murphy[2], Ulric O'D. Trotz[3], Leonard A. Nurse[4], and Steve M. Blasco[5].

1. Oceans of Mystery
2. Oceans of Mystery

Continued on next page ...

3. Caribbean Planning for Global Climate Change
4. Coastal Zone Management Unit
5. Geological Survey of Canada

Spatial and Temporal Analysis of Prairie Ecozone Summer Drought Since 1920 As Calculated From The Rehabilitated Canadian Historical Daily Climate Database
K. Heinze[2], W.R. Skinner[1], L. Vincent[1], and E. Mekis[1]
1. Environment Canada
2. University of Waterloo

Russia's Role in Addressing Global Warming
Kimberly Heuckroth
Carleton University

Impacts of Climate Variability and Change on Ecosystem Management in Riding Mountain National Park
Bonnie Hui
University of Waterloo

Climate Change and Extreme Events: Are Canadians Vulnerable?
A Glimpse at the 1998 Ice Storm
Brenda Jones
University of Waterloo

Will Coral Reef Mapping Outrun Climate Change?
Candace M. Newman and Ellsworth F. LeDrew
University of Waterloo

Air Quality Assessment of Traffic in the Kitchener-Guelph Highway 7 Corridor
Jennifer Niece
University of Waterloo

Modelling Lake Huron Shoreline Change Using a GIS and General Circulation Model (GCM) Water Level Data
Ryan Schwartz and Peter Deadman
University of Waterloo

Climate Change Outreach Exhibit: Canadian Institute Of Child Health – Changing Habits, Changing Climate
Sandra Schwartz
Canadian Institute of Child Health

Community-Based Evaluation of Climate Change for the Bay of Quinte Watershed – Implications and Strategies for Sustaining Environmental Quality
Robert Walker and Fred Stride
Eb.In.Flo

Experimentally Flooded Reservoirs: Using Stable Carbon Isotopes to Investigate Sources for Greenhouse Gas Production

N. Boudreau, S. Schiff, V. St. Louis, E. Joyce, D. Bodaly, R. Aravena, and R. Elgood

ABSTRACT

Greenhouse gas production in reservoirs is an emerging concern. Decomposition of flooded organic matter increases production of carbon dioxide and methane. Greenhouse gas flux from reservoirs should be proportional to the amount of organic carbon flooded. Hydroelectric reservoirs in northern Canada flood both peatlands and upland forests. The Experimental Lakes Area Reservoir Project (ELARP) experimentally flooded a peatland to assess changes in greenhouse gas (GHG) production after flooding. Flooding changed the wetland from a small carbon sink to a very large carbon source. Wetlands contain large stores of organic carbon and are the worst-case flooding scenario. The Flooded Uplands Dynamics Experiment (FLUDEX) is currently flooding upland boreal forests to test the hypothesis that smaller carbon stores should minimize post-flood effects.

Three upland boreal forests of varying moisture and carbon content were flooded in 1999. *Before flooding, we constructed a pre-flood carbon inventory to quantify and locate decomposable organic carbon. The moist forest had the most available carbon, the very dry forest the least, and the dry forest was intermediate. The forest floor is the greatest carbon stock and the most likely to fuel GHG production on the short term. We used stable carbon isotopes to characterize and differentiate between potential vegetation and soil horizon sources for GHG production. This pre-flood data, which is lacking for existing reservoirs, allows us to calculate the* net *effects of flooding. After flooding, isotopic analysis of various reservoir waters allows us to identify carbon sources for GHG, the production pathway for the gas, processes affecting the gas, and further constrain flux calculations.* ❑

Resilience and Adaptation: Social Systems, Coastal Communities, and the Challenge of Climate Change

Jodi Browne

ABSTRACT

Even if greenhouse gas emissions ceased today, experts agree that the world will still be forced to adapt to some degree of climatic change due to the time lag involved between emissions and their consequences. In addition to the biophysical impacts brought on by changes in the natural environment, it is likely that we can also expect significant repercussions for social and economic systems. Coastal communities, particularly those in developing countries, have been identified by the IPCC as especially vulnerable to the effects of climate change.

This paper explores what makes particular regions or communities more susceptible to negative climate impacts, by examining which system features contribute to vulnerability. A suite of characteristics is examined that contributes to the ability of impacted coastal communities and regions to cope with changes in climate, while continuing to support effective and productive social and economic systems. In particular, discussion focuses on the roles of resilience and adaptation as components of social response and vulnerability.

In conclusion, the paper presents a conceptual spectrum encompassing a number of social responses to changes in the natural environment ranging from steadfast and elastic resilience through adaptation. The spectrum can be used as a tool to classify ideas about how communities faced with environmental change are vulnerable, and how they react in response to this change. ❑

Identification of Links Between North American Prairie Snow Cover and Atmospheric Circulation

C. Derksen, E. LeDrew, A. Walker, and B. Goodison

ABSTRACT

With a high degree of seasonal and interannual variability in spatial extent, identifying associations between elements of the cryosphere and the atmosphere is essential for understanding, modelling, and predicting the global climate system. The investigation of terrestrial snow cover is particularly intriguing because of the complex nature of the interaction between snow on the earth's surface and atmospheric circulation. While the presence or absence of snow cover modifies energy exchange with overlying air masses, it is these air masses themselves which deposit and ablate snow cover. In addition, significant hydrological processes are also influenced by snow cover, which acts as the frozen storage term in the water balance. Productive agricultural regions such as the Canadian Prairies rely heavily on spring meltwater for crop irrigation. The synergy between global energy and water cycles, and the important role that terrestrial snow cover plays in both of these cycles, enforces the need for spatially continuous, temporally repetitive, and synoptically sensitive observation of snow cover to adequately monitor and model these systems. To meet these data objectives, remote sensing has been utilized as a data source for examining variability and change in both the cryosphere as a whole, and terrestrial snow cover specifically. In this study, ten winter seasons (December, January, February 1988/89 to 1997/98) of five day averaged (pentad) satellite passive-microwave derived snow water equivalent (SWE) imagery are utilized to examine the seasonal snow cover characteristics of a ground-validated North American Prairie study area. Principal components analysis (PCA) is used to identify the dominant spatial patterns through time for three passive-microwave derived datasets: (1) pentad SWE, (2) pentad SWE anomalies based on the 10 season mean and standard deviation, and (3) change-in-pentad SWE (DSWE) calculated by subtracting each SWE pattern from the previous. Interpretation of the component loading patterns indicates that the DSWE time series is best suited for the climatological application of identifying associations between snow cover and atmospheric circulation. Two dominant patterns are identified within the DSWE time series: the positive (negative) phase of principal component 1 captures a pattern of widespread SWE ablation (accumulation) in the south with accumulation (ablation) to the north. The positive (negative) phase of principal component two characterizes a meridional accumulation (ablation) zone oriented from the northwest to southeast of the study area. National Center for Environmental Prediction (NCEP) gridded atmospheric data (500 mb geopotential height; 700 mb temperature) are investigated in conjunction with the first two DSWE principal components and show that unique and consistent atmospheric circulation patterns are linked to each phase of the leading DSWE components. ❑

Connecting Climate Change to Local Environments along the Great Lakes

Patrick Donnelly and Geoff Peach

ABSTRACT

A large body of knowledge has been developed on the science and impacts of climate change in Canada. This information has been relatively slow to reach the grassroots level. In an effort to educate a broad constituency about environmental issues, local conservation organizations in Ontario have realized that community environmental education can be accomplished through effective elementary school initiatives. This approach has been especially powerful when the effort to develop an understanding of the issue was complimented by efforts to engage students into proactive, environmental behavioural change (e.g., recycling, water conservation, school grounds naturalization). Young students often act as a catalyst for change by passing new knowledge and values onto family and friends. In short, by raising the level of awareness and understanding of an issue, or transposing learned behaviours, students create a 'multiplier effect' within the community. Introducing environmental issues through the school system also serves as a solid foundation from which to build effective community outreach campaigns. By entrenching climate change in the formal education system, parents will gain some exposure to the issue through their child's schoolwork. This has the added benefit of improving the credibility of subsequent community outreach messages. However, obstacles exist when dealing with climate change educational material: a) the information is fragmented and time consuming for the teacher to collect; b) the information tends to use general concepts at a global or continental scale; and c) the information does not meet the Province of Ontario's new curriculum guidelines.

An educational resources kit, "Connecting Climate Change to the Local Environments along the Great Lakes" is being developed to overcome the above obstacles and make the information on climate change, particularly as it relates to the Great Lakes region, accessible to elementary teachers for use in their classrooms. The kit would be:

- *easily updated as new information becomes available;*
- *make use of existing interactive internet sites;*
- *include hands-on activities that allow students to interact with their environment;*
- *consistent with the requirements of Ontario's new Science and Technology and Social Studies Curricula*
- *applicable to the Great lakes region with specific local examples and potential impacts to the local Lake Huron region.*
- *composed of hands-on (both classroom and outdoor) activities and a field trip component that reinforces the classroom information.*
- *a catalyst for students to take action to reduce greenhouse gas emissions.*

Similar in design to a kit already developed by the Coastal Centre on the topic of Lake Huron's Beach and Dune Ecosystems, the climate change kit would be comprised of the following chapters:

- *Climate History*
- *Human Influences on Climate Change*
- *Potential Impacts on Great Lakes Environments*

- *Potential Impacts on Local Communities*
- *Reducing our CO2 Emissions locally*
- *Local Field Trips*

Each chapter will consist of:

- *Teacher's notes - intended to provide a more detailed examination of the subject matter*
- *Student's notes - prepared to correspond with the grade level of the student*
- *Activities - hands-on programs particularly beneficial to visual and kinetic learners.*

As teachers in the Province of Ontario struggle to find teaching resources that meet the new curriculum guidelines, there is an opportunity to develop resources on issues such as climate change, which are environmentally, socially and economically relevant, and can satisfy a number of curriculum topic areas and outcomes. ☐

Communicating Climate Change Issues To The Public Through Television Media

Rick H. Haupt, Gordon Murphy, Ulric O'D. Trotz, Leonard A. Nurse, and Steve M. Blasco

ABSTRACT

Communicating climate change issues effectively to the public using the medium of television is difficult primarily because of competition from alternate programming airing at the same time. To be effective a television program must first capture the viewer's attention then maintain interest by being entertaining and informative without being too technical or complex. In addition, short viewing times of 22 or 44 minutes allow limited time for information transfer. Scientific and technical information must be simplified to reach the average television viewer. However, the use of integrated video and audio communication formats in the television medium allows for a higher data transfer rate than with written media.

By its very nature climate change is a complex scientific and technical topic. However, television is a unique medium. Through the effective use of action footage, dynamic animation, interaction with scientists at work, upbeat music, and incorporation of a sense of adventure, climate change issues can be presented to the public in an entertaining, informative and easily understood format.

A successful example of effective communication of climate change issues to the public is the Oceans of Mystery Discovery Channel episode on the reefs of Barbados. The viewer's attention is immediately riveted and sustained by the mystique of shipwrecks in the shallow waters of the Barbados coast. The viewer is introduced to the reef ecosystem of Barbados, related climate change issues and ultimately the impact of climate change on the peoples of the Caribbean and around the world.

Through the effective use of high quality underwater digital video, up-tempo music, dynamic animation, action footage involving SCUBA divers and scientists at work and short, focused personal interviews with scientists actively involved with reef research, the viewer is not only informed but entertained as well. Issues brought before the public in this one hour (44 minutes plus advertising) program include the status and fate of the reef ecosystem, factors contributing to reef decline, the impact of reefs on the carbon dioxide cycle, implications of reef decline for climate change, paleoclimatic record of ancient corals, and reef preservation and restoration. Shipwrecks contribute to reef preservation. As artificial reefs, wrecks colonized by corals become the focus of the growing SCUBA diving tourist industry. Diverting diving activities to artificial reefs contributes to the health of reefs already under significant environmental stress. A proven reef restoration process of reattaching broken corals is also documented on film.

The strategy used in the production of this successful Barbados program (circulated in over 130 countries) could be a model for communicating a wide range of climate change issues to the television viewer. Public awareness and education are the first steps in the process of mitigating anthropogenic contributions to climate change. Television, with its wide audience and personal appeal, could play a key role in the effective communication of climate change issues and impacts as well as the identification of the roles individuals play in remediation. ❑

Spatial and Temporal Analysis of Prairie Ecozone Summer Drought Since 1920 As Calculated From The Rehabilitated Canadian Historical Daily Climate Database

K. Heinze, W.R. Skinner, L. Vincent, and E. Mekis

ABSTRACT

Daily water balance parameters using the Thornthwaite water balance model and monthly Palmer Drought Severity Index (PDSI) values are calculated for approximately 35 stations on the Canadian prairie grassland ecozone using the rehabilitated long-term daily mean temperature and daily total precipitation data sets from the Climate Research Branch of Environment Canada. Station PDSI values from 1920 to 1997 are objectively interpolated onto the 50 km resolution CANGRID. The gridded data are analysed spatially and temporally for the climatological summer season (average of June, July and August) and for the individual months in the growing season (May, June, July, August) to determine both the validity and utility of these new drought indices. Climatological 30-year normal patterns of PDSI are mapped and analysed. Three common patterns of prairie ecozone moisture conditions are identified using Empirical Orthogonal Function (EOF) analysis, a west/east pattern, a north/south pattern, and a west/central/east pattern. The gridded monthly PDSI values are then examined temporally and mapped to provide insight into the nature of changing prairie moisture conditions since 1920. This study provides baseline information for the analysis of synoptic forcing mechanisms of prairie drought and for the reconstruction of pre-instrumental drought over the past few centuries using climate proxy data. ❑

Russia's Role in Addressing Global Warming

Kimberly Heuckroth

ABSTRACT

With the largest land area in the world and some of the greatest reserves of natural and mineral resources on Earth, Russia's future economic and industrial development patterns have the potential to drastically alter the equilibrium of the global environment. Given that Russia is the third largest emitter of carbon dioxide in the world and that forested areas in Siberia and the Far East alone represent 20% of the Earth's forests, Russia has a crucial role to play in international efforts to address the problem of global warming. In view of the important position that Russia occupies within the global environment, a study was undertaken to examine the degree to which global warming is considered to be a priority by Russia's government, non-governmental organizations and citizens. It was found that the Russian government has not been a totally reliable partner in international efforts to combat global warming, explained partly by economic and political instability. Environmental organizations represent the largest sector in Russian civil society, and while a significant number were found to have a global focus, they are highly dependent on foreign assistance. Even though Russia's citizens have a very low level of knowledge about global warming, they still show a high degree of concern for environmental issues. Future progress on combating global warming will depend on Russia's commitment to developing sustainable economic and democratic systems which will ensure that society has the opportunity to become an effective grassroots force to influence environmental policy. ❑

Impacts of Climate Variability and Change on Ecosystem Management in Riding Mountain National Park

Bonnie Hui

ABSTRACT

Canada's National Park System provides an excellent opportunity to assess our country's ecological health and contribute to the understanding and monitoring of climate variability and change. This study examines the potential ecosystem impacts of climate variability and change for Riding Mountain National Park (RMNP), Manitoba. RMNP is located at the junction of three ecosystems – rough fescue grassland, boreal forest and aspen parkland. Climate sensitivities of ecosystem transition zones or ecotones will likely make RMNP among the first to experience the impacts of climate change. Using two recent General Circulation Models (GCMs) – the first generation Canadian coupled model (CGCMI) and the United Kingdom's Hadley Centre for Climate Prediction and Research model (HadCM2), climate scenarios for temperature and precipitation were derived for RMNP. GCM results provide RMNP managers with plausible future climate change scenarios. In addition, an extensive literature review and interviews with experts established potential ecosystem sensitivities and impacts. Coordinated regional efforts are required to protect ecological integrity within RMNP. The study identifies the barriers and opportunities of coordinating regional efforts allowing positive actions to be initiated. Despite uncertainties plaguing climate variability and change predictions, there is consensus that a stable, unchanging climate is least likely. Among other things, protected area managers must contend with rapid, unpredictable climate change over the next century. A recent report by the Ecological Integrity Panel suggests our National Parks may not be capable protecting ecological integrity, even without human induced climate. We need to examine park policies and ecosystem management plans to ensure that climate variability and change are considered in our quest to maintain ecological integrity. ☐

Climate Change and Extreme Events: Are Canadians Vulnerable? A Glimpse at the 1998 Ice Storm

Brenda Jones

ABSTRACT

The 1998 Ice Storm has been labeled as one of Canada's worst disasters, not only for its socioeconomic impact, but because it facilitated the largest technological failure of any disaster event in Canadian history. At its peak, nearly 10% of Canada's population was without power The Ice Storm clearly illustrated society's dependence on modern technology and our vulnerability when it fails to be resilient. Although numerous structural and behavioral adaptations were made in the months following the ice storm to reduce future vulnerability, concerns have been raised that society may be ill prepared to cope with potential changes in the frequency of high magnitude events, (e.g., ice storms, floods) that could be possible under the projected impacts of climate change. This poster explores the characteristics of the 1998 Ice Storm and the vulnerability of Canadians to future extreme events. ❏

Will Coral Reef Mapping Outrun Climate Change?

Candace M. Newman and Ellsworth F. LeDrew

ABSTRACT

Coral reefs are well known for their aesthetic beauty and economic benefits, however, in both cases reefs are put under anthropogenic pressures for which they have no defenses. For example, in many coastal communities blast fishing and cyanide poisoning destroys the living outer veneer of a reef. Exotic fish traders and shell collectors remove an abundance of selected organisms altering hierarchical community fish structures. Natural stressors as well, however, can have deteriorating effects on reefs. Mathematical models predict increasing sea surface temperatures, increasing sea levels as well as increasing frequency and intensity of storms. Physical damage caused by natural stressors leaves reefs more vulnerable to anthropogenic disturbances. Climate change, therefore, is a major threat to coral reef environments.

A potential solution to preserve and conserve coral reefs lies in our ability to accurately map the spatial extent of their health over time. A technology that can document the scale, extent and duration of ecosystem change would be highly valuable and assist managers in designing short- and long-term management strategies. Remote sensing technology may offer a solution. With constantly changing environments, sensors on-board aircrafts can image large areas systematically and repetitively recording modifications in the environment within a short period of time.

Although mapping coral reef environments using remote sensing is advantageous, there are a number of complications. Three issues that disrupt accurate mapping are founded in the changes a remotely sensed signal undergoes as it travels through the atmosphere, interacts with the earth's surface and travels through the water column. For the purposes of this study changes to a signal as it travels through the water column and interacts with the bottom at various depths are examined. Results indicate that a complex approach is required for accurate coral reef mapping. ☐

Air Quality Assessment of Traffic in the Kitchener-Guelph Highway 7 Corridor

Jennifer Niece

ABSTRACT

A proposal by the Ministry of Transportation (Ontario) to build a controlled access expressway between Kitchener and Guelph has sparked strong local opposition in recent years. The project is based on projections of an average 46% increase in traffic demand between the two cities by 2011. In a region that already has a reputation for poor air quality, the Highway 7 environmental assessment report has been criticized because it contains virtually no consideration of greenhouse gas emissions or impacts on local air quality. The report has also been criticized for failing to examine small-scale, multiple-occupancy transportation alternatives that will reduce production of pollutants and may eliminate the need for a new highway.

This study considers these criticisms by comparing seven different scenarios (including 1999 traffic levels and 2011 traffic demand predictions with various modal-split ratios) on the basis of CO_2*, CO, volatile organic carbons (VOCs), and* NO_x*. The many variables affecting the airshed prevent calculations on ambient concentrations of priority pollutants. However, the absolute quantities can be compared to government targets for reduced production (by volume) of the target pollutants on a province-wide basis.*

Results indicate that if the Kitchener-Guelph Highway 7 corridor were viewed as a closed system it would be impossible to meet government targets with respect to Ontario's Drive Clean program (22% reduction of NO_x *and VOCs) and the Kyoto Protocol (6% reduction from 1990 levels). Increases in fuel efficiency predicted by Natural Resources Canada and provincial targets for improved maintenance are not enough to offset the absolute increase in vehicle kilometres traveled in the corridor. Since Highway 7 is not actually a closed system, if targets are to be met, the anticipated increase in tailpipe emissions would have to be compensated for by other fossil fuel burning sectors of the province.* ❑

Modelling Lake Huron Shoreline Change Using a GIS and General Circulation Model (GCM) Water Level Data

Ryan Schwartz and Peter Deadman

ABSTRACT

Climate change could have a significant long-term impact on water levels in the Great Lakes. Recent research studies have indicated that water levels are projected to decline toward the latter part of this century. To date, little research has focussed on the potential impact this change may have on the socioeconomic and biophysical systems of the Lake Huron shore. This poster outlines a methodology to assess and quantify the potential impact of declining water levels on the Lake Huron shore at Goderich, Ontario. The methodology proposed here utilizes a geographic information system (GIS) to combine topographic and bathymetric data sets. A continuous digital elevation surface of the shore and nearshore areas is produced upon which projected water levels derived from Canadian general circulation model (GCM) output are plotted. By creating a series of hypothetical shorelines at Goderich, a range of sensitivities, impacts and costs can be identified for the Goderich Harbour. The model is validated by comparison with observed and recorded water level data as well as air photos corresponding to the 1964 Lake Huron record low water level event. The methodology can be expanded along the entire Lake Huron shore in an attempt to explore the implications of changes in climate and water levels on the tourism and recreation, shipping and navigation and shoreline development sectors of Ontario's economy. The model could be used as a planning tool by decision and policy makers and could support further shoreline management and climate impact and variability studies in other Great Lakes. ❑

Climate Change Outreach Exhibit: Canadian Institute Of Child Health – Changing Habits, Changing Climate

Sandra Schwartz

ABSTRACT

Climate change may have significant impacts on the health of Canadian children by affecting the quality of air, food and, water and the stability of ecosystems on which we depend. In response to these health concerns, the Canadian Institute of Child Health launched its Changing Habits, Changing Climate project in June 1999.

The goal of the project is to build public awareness and understanding on the implications of climate change on the health of children. The Canadian Institute of Child Health believes that when armed with the necessary information to better understand climate change and its potential implications on child health, parents and health professionals can take action on reducing greenhouse gas emissions and make informed behaviour changes.

We know that on an individual level, concern for the environment arises as a result of the potential health risks associated with exposure to environmental hazards. Thus, if a link between climate change and health is made, a better understanding of the benefits to taking action on climate change will likely result. Climate change brings together environment and health issues in several dimensions through raising awareness about climate change and the subsequent health risks. The result will be more meaningful engagement and more sustainable changes in behaviour.

This project has used a phased approach with a foundation analysis component and a public outreach strategy. The foundation analysis component is a review of current literature, data and information on the implications of climate change on urban and rural child and family health. The purpose of the foundation analysis is to provide the background for the Canadian Institute of Child Health's public outreach strategy and establish a credible and balanced resource, which is user-friendly and accessible to all Canadians.

The outreach strategy is targeted at parents, health professionals, grandparents and children independently, and includes a series of information sheets on subjects such as transportation and solvents, to engage, inform, and encourage actions to reduce greenhouse gases in homes, schools, workplaces, and communities.

The thrust of the Changing Habits, Changing Climate program is to effect three types of outcomes:

1. *To mobilize health professionals through increasing their knowledge and understanding of the health issues associated with climate change. Additionally, their role in building awareness of these issues among families with children will be instrumental.*
2. *To increase public awareness by educating individuals (parents) on climate change and its impacts on the health of children and their families.*
3. *To support behaviour change by providing concrete and balanced information on what people can do to reduce greenhouse gas emissions.* ❑

Community-Based Evaluation of Climate Change for the Bay of Quinte Watershed – Implications and Strategies for Sustaining Environmental Quality

Robert Walker and Fred Stride

ABSTRACT

Estimates of direct hydrological impacts in the Bay of Quinte watershed have been made for various climate change scenarios using a watershed model and future climates estimated by the Canadian General Circulation Model. Reductions in annual and summer streamflow are expected to occur as atmospheric CO_2 *increases. The changes could impact negatively the actions implemented to "delist" the Bay of Quinte as a Great Lakes Area of Concern. The non-government group, Quinte Watershed Cleanup, has introduced a results-oriented, multi-phased program to increase awareness, investigate local cost implications, find community-led solutions and sustain environmental quality. The program includes the following components:*

- *a preliminary information session to present the predicted impacts of climate change;*
- *a two-step policy Delphi questionnaire to solicit expert thought;*
- *a follow-up workshop to engage stakeholders and discuss local strategies/priorities;*
- *an economic assessment of costs;*
- *communications with the community; and*
- *actions to demonstrate adaptation and mitigation strategies.*

Components of the climate change research and the community-based program are highlighted. ❑

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CLIMATE CONTROL

Special issue investigates opportunities for cutting greenhouse gas emissions

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Dealing with uncertainty • Cutting emissions in half • Top ten ways to get there
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See next page for list of contents ...

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Climate Control

Table of Contents

8 **Proof or Consequences** .... LYDIA DOTTO
Skeptics say we should wait for proof before taking action on climate change. If they turn out to be right, we'll have saved a lot of bother. But if they're wrong ...

13 Inset: **Industry Fossils Deny Problem**

15 **The Science** .... HENRY G. HENGEVELD
Global temperature is on the rise and the dangers are real and significant.

17 **Warped Tables** .... D.W. GILLEN & W.G. MORRISON
The decision-making process used by Canada's climate change round tables has built-in biases.

19 **Arduous TREC** .... MICHAEL ANDERSON
An urban wind energy co-op faces opposition from people who prefer their turbines elsewhere.

20 **Good News** .... JASON RYAN & ANICKA QUIN
Alternatives *highlights the top ten climate stabilization initiatives in Canada.*

22 **Mind the Gap** .... RALPH D. TORRIE AND RICHARD PARFETT
The discussion so far has focussed on how to meet our modest Kyoto commitments. But the real problem is the gap between our current emissions and the dramatic reductions necessary to stabilize global climate.

30 **Generating Jobs** .... CARRIE SONNEBORN
Sustainable energy initiatives deliver more jobs and lower greenhouse gas emissions.

32 **Back From the Future** .... JOHN ROBINSON & DEBORAH HERBERT
Future scenarios can help us foresee where climate change is leading and how we can choose a more sustainable path.

34 **Warming Trend** .... SIDNEY RIBAUX
Quebec community groups are helping low-income households save energy and cut home heating bills.

35 **Way to Go!** .... CATHERINE O'BRIEN
Initiatives across the country get kids to school the sustainable way.

36 **Household Greenhouse Gas Emissions Questionnaire**
Find out how you fair on your greenhouse gas emissions and get some tips on how to reduce them.

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Editorial

JUST ANOTHER REASON

The basic climate change facts are simple enough. Concentrations of greenhouse gases in the global atmosphere are much higher than they used to be. These concentrations are still rising as we burn our way through the global stock of fossil fuels. And the new atmospheric chemistry will bring changes in climate systems.

The precise nature of these changes and of secondary effects on weather patterns, ice caps, ocean currents, microscopic biology, etc., is beyond confident prediction. So is the timing and severity of these effects.

But the changes are unlikely to be simple. The systems involved are too complex and interrelated. Instead of just warming, we are likely to get new patterns of warming and cooling, drought and flood. Instead of just gradual shifts, we may well get sudden flips from one pattern to another.

Even slow climate changes will be messy. Quick ones will be ugly. We don't know how messy or how ugly, and we aren't likely to have a much clearer picture any time soon. As Lydia Dotto says in this issue of *Alternatives*, the uncertainty is unavoidable. Deal with it.

We have two serious options – mitigate and adapt. Full prevention is no longer possible. Some warming and other associated changes have already occurred, and there is no plausible scenario for an immediate stabilization of greenhouse gas concentrations.

Much current reporting on climate change seems to imagine that cutting greenhouse gas emissions to a little under the 1990 level (the Kyoto goal) will stabilize greenhouse gas concentrations. Not so. It will just stabilize the rate of increase. We will still be pumping out huge quantities of greenhouse gases.

Ralph Torrie calculates that if we want to stabilize concentrations, we will probably have to cut global emissions by 50 percent in the medium term and by more than 70 percent overall before the end of this century. For practical as well as ethical reasons, the cut for rich developed countries including Canada will have to be much higher. And that will still leave atmospheric greenhouse gas concentrations at roughly double the pre-industrial level. It will mitigate the threats; it will not prevent them.

Adaptation might sound easier. But since we are unsure about what to prepare for, adaptation mostly means redesigning our lives – our transport, energy, food and water systems, our economies and settlements, even our dreams and aspirations – for much greater resilience and flexibility.

Either way, it's no small thing. No wonder there is so much denial, obfuscation and willful confusion among the defenders of things as they are.

And yet, there are plenty of opportunities for practical and useful action. The trick is to see beyond climate change and greenhouse gas reduction. Deep cuts in fossil fuel use and broad redesign of infrastructures may never be sufficiently popular if they are seen only as steps to address a distant and ill-defined threat. But most of what is needed for climate change mitigation and adaptation purposes is also desirable for other reasons.

Better public transit, greater diversity of renewable energy sources, more efficient buildings, less urban sprawl – all these and a thousand other greenhouse gas reducing initiatives are worth pursuing for reasons quite aside from climate change concerns.

In a country that is failing dramatically to meet its modest Kyoto commitments, Ralph Torrie argues quite cheerfully that we could cut our greenhouse gas emissions in half. He says we can do this because most of the key reduction measures are based on technologies and social processes that have been in the works since long before climate change became a major worry.

The Danish windmill industry, Ballard's fuel cells, the movement against urban sprawl, car co-ops and community groups providing home weatherproofing are among the initiatives that are now getting a boost because of climate change concerns. But their initiators and proponents started with and retain quite different goals. They were looking for more jobs, less dependence on imported fuel, smog reduction, preservation of agricultural lands, a stronger sense of community, economic savings and a host of other benefits that virtually everyone can appreciate.

Amidst all these, the threat of global climate change is just one more reason for doing what we should be doing anyway. ◼

Robert Gibson

– Robert Gibson

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